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No. 1

DISTURBANCE OF THE ATTENTION DURING SIM-
PLE MENTAL PROCESSES.

BY EDGAR JAMES SWIFT.

The purpose of the present investigation was to test the accuracy of earlier experiments and to throw new light on some aspects of the subject. The experiments were made in the laboratory of Professor Ebbinghaus, in Berlin, beginning in May, 1890, and extending to February, 1891. The laboratory consists of a single room; this made it impossible for the reactor and the one who conducted the experiments to be separated. There was no conversation, however, during the progress of the experiments, except as the reactor said "worthless" when some abnormal conditions made the value of a certain reaction doubtful. The work was carried on late in the afternoon and in the evening, when the surroundings were quiet. A signal always preceded the excitation by about three fourths of a second.

A Hipp chronoscope of the new pattern was used. Its accuracy was tested regularly. The description is given in Wundt's *Psychologie*.¹ The reactor was George A. Coe, Ph. D., an American, who kindly lent his assistance to my investigations, and to whom I am indebted for many valuable suggestions.

The sound which served as the excitation for the simple muscular reactions was caused by the striking together of two weights. Each weight was connected with the circuit in such a way that when they touched one another the circuit was closed. This sound called for a response with the first finger. The striking together of the same weights gave one of the sounds when a choice between two movements was to be made. The first and second fingers of the right hand were used in reacting. The key-board consisted of five keys connected in the usual way. The sound of the weights was

¹ 3d. ed. p. 275 VII.

responded to with the first finger, by the pressure of which, upon the key, the current was broken and the chronoscope stopped.

The other sound was produced by the dropping of a ball from the arms of a Hipp fall apparatus.¹ The moment the ball reached the board below the electrical current was closed and the chronoscope started. The muscles of the arm and hand were tense, ready for action, and the attention closely concentrated on the movement to be made. As soon as possible after hearing the sound, the reactor would break the current by pressing a key.

The preliminary experiments suggested other questions, which stood in such close relation to the ones at issue that their investigation seemed desirable. It has been thought best to first introduce some of these experiments, which really came later in the series, as in many cases they have a bearing on the others.

For some time I have been convinced that it is a wrong method to take reactions of one or possibly two kinds, on certain days, and finish those of one sort before beginning the others. Reactions whose results are to be placed in immediate comparison with one another should be taken on the same days, and the order of succession of the different kinds should be changed from day to day, so that the disturbing influences of weariness, practice, and other less easily controlled conditions, may, so far as possible, be eliminated or equalized.

In some of the earlier experiments which I made, in which a choice between two movements was necessary, the reactors said that they found themselves at times involuntarily "guessing" which of the two sounds would come next, and they thought that the reaction followed much more quickly sometimes, on account of their correct conjecture. J. V. Kries² has already called attention to the fact that a reaction will follow more or less quickly according as a presentation of the movement to be carried out is already in the mind or not. In order that this might be tested, two series of experiments were made, which I will call the "chance" and "non-chance" series. In the "chance" series the succession of the two sounds which served as excitations, and to each of which a particular movement responded, was previously determined by tossing of a copper coin. In the "non-chance" series I followed the dictates of my mind in the succession, but made every possible effort to keep the order uncertain.

¹ Wundt's *Psychologie*, 3d ed. II. 275.

² *Vierteljahrsschrift für Wissenschaftliche Phil.* 1887 II. 4.

The experiments were performed according to the plan mentioned above. Some of each of the two kinds were taken every day, and those that came first one day would come last the next. In this way it was hoped to equalize many disturbing and uncertain elements.

A high card-board partition separated Dr. Coe and myself. It was thus impossible for him to receive any suggestions from such movements as I might make.

Table I. shows the results of the first set. The purpose was to determine the difference between the "chance" and

TABLE I.

Date.	Reaction ¹ in Chance Series.	M. V. ²	Number of Experi- ments.	Reaction ¹ in Non-chance Series.	M. V. ²	Number of Experi- ments.
1890.						
Nov. 17	218	30	23	193	35	38
" 18	230	29	45	198	33	53
" 19	204	29	49	206	21	51
" 20	210	32	49	209	30	61
" 21	205	25	39	216	24	37
" 21	204	21	18	188	19	22
" 22	203	33	27	197	23	28
" 22	198	23	26	193	26	34
" 24	210	18	25	193	26	34
" 25	166	19	31	169	21	34
" 25	185	31	31	169	21	35
" 26	175	20	30	188	25	31
" 27	177	28	31	160	27	37
" 28	187	32	30	167	18	33
" 28	176	26	29	160	17	33
" 29	170	22	30	160	25	34
	195	25		186	24	

¹ The figures denote $\sigma = 0.001$ sec.

² M. V. = mean variation.

"non-chance" method. Sixteen averages, gained from a varying number of trials, are given in each series, and in nine of these the "chance" series is markedly longer than the "non-chance." In two cases the "chance" is less than the "non-chance," and in five the two are so nearly equal as to be considered practically the same. In three of these the excess, though slight, is still in favor of the "chance" series. The average difference is 9σ .

The reactor did not know the order of the two series, but he always "felt" a difference in them. Each day at the close of the evening's work he would guess which had been the chance series, forming his opinion from the feeling of greater ease which was associated with the one or the other series, and almost without exception his judgment was correct.

A doubt, however, suggested itself. Perhaps Dr. Coe's knowledge of the problem to be solved unconsciously influenced his reactions. That this might be tested I asked Mr. Mulfinger, also an American, to react for a few days. Mr. Mulfinger had gained experience in reacting during the previous semester, but knew nothing whatever of the question at issue until all the experiments had been completed. The result of 100 experiments in each series was as follows: reaction-time for the chance series 193σ , with a mean variation of 29σ , and for the non-chance series 168σ , with a mean variation of 23σ . Mr. Mulfinger also felt less difficulty in responding to the "non-chance" series, though he had no knowledge whatever regarding the object of the experiments or the difference between the series.

The inference from these experiments is clear. The mind of the experimenter works according to certain laws of regularity which he cannot escape. This regularity will assert itself in the way in which he chooses between the two stimuli and in time may disclose itself to the other mind, though the latter is conscious of it only through a vague feeling. Had I not tried to make the non-chance order perplexing to the reactor, the difference between the two series might have been still greater, as the mind would then have been free to follow its inclination.

In both of the preceding cases the number of single experiments made at one sitting varied from twenty to sixty. The difference of the two kinds was not found when the experiments were made in short series of 9 to 16, the averages being practically the same. A little time seems to be necessary before the reactor's mind can become master of the law of regularity which the other unconsciously follows.

It seems probable, therefore, from the results of these investigations that all experiments in which a choice is involved

should be made either in a chance order or the number of successive trials should be limited to ten or twelve. Otherwise the law of regularity of the mind will betray itself in the order of succession and the results will contain a constant error. In all of the following experiments in which a choice forms a part, I have followed a chance order, determined as before by the tossing of a coin. This was necessary in investigations of this nature because the stopping of the work at the end of twelve trials would have kept the reactor's mind in a constant state of unnatural excitement. The importance of this will be seen when we reach the experiments that test the influence of different grades of disturbance.

We now turn to the first set of experiments to show the effect of a disturbance on the reaction-time. These preceded the experiments given in Table I., as will be seen from the dates, but as they do not involve a choice the question of chance does not affect them.

It is evident that when a question of a disturbance of the attention is being investigated, great care must be taken in rejecting figures. When the numbers to be discarded are judiciously selected the results can be made to support almost any previously acquired theory. For this reason I have rejected few figures and seldom when the reactor did not himself say immediately after reacting that some unusual disturbance had made the reaction valueless. In the other few cases where a figure was rejected, it varied so much from any of the others as to leave no doubt of its worthlessness.

The arrangement of the apparatus was the same as before. The large card-board partition kept the reaction free from such disturbances as might otherwise have influenced his reactions.

The following set consists of two series, the simple muscular reaction¹ in response to an excitation of the sense of hearing and the same taken while a metronome was ticking one hundred and twenty times each minute. Not only were some of both series taken every day, but the order in which they were taken was also alternated, so that on one day the simple muscular reaction preceded the muscular reaction with the disturbance, while on the next day the order was reversed.

As the result of 100 experiments in each series made under exactly similar conditions, the simple muscular reaction-time was 103σ , with a mean variation of 9σ , whereas the reaction-time, with disturbance of the attention by the ticking of the metronome, was 122σ , with a mean variation of 12σ , the atten-

¹WUNDT, *Physiologische Psychologie*, II. 265, Leipzig 1887.

tion being given to the movement to be made. The lengthening due to the disturbance is 19 σ .

It would seem that the ordinary muscular-reactions are affected by a disturbing sound. Obersteiner's investigations¹ have already supported this view, but his method was hardly satisfactory. The playing of a music box served as his disturbance and the reaction-time under these conditions was learned. That the time required when the attention was undisturbed might also be found, the playing occasionally ceased just before the excitation was given. The sudden stopping of a sound would tend to startle the reactors and the reaction following would hardly be reliable.

Cattell claimed² that the reason why some earlier investigators found the reaction time lengthened by a disturbing sound was probably due to the fact that the reactors had not learned to make their reactions automatic. It can hardly be considered as yet fully settled that the muscular reactions are strictly automatic, if by this he means purely brain reflex. This has lately been made doubtful by the investigations of Dr. Götz Martius³. Dr. Coe, whose reactions are given in Table IV., had reacted from the beginning according to the so-called muscular method, and his instructions during these experiments were to keep his muscles innervated and his attention strictly on the movement to be carried out. No attention whatever was to be given the disturbance and the reaction was to follow the excitation as quickly as possible. Wundt in the third edition of his *Physiologische Psychologie*, II. 290, supports Cattell's opinion.

In view of these results I am unable to agree in the opinion that muscular reactions are not lengthened by disturbing sounds. The separate averages are fairly regular and in every case the muscular reactions taken during the disturbances are longer than the others. The final average, gained in each case from one hundred trials, gives a difference of 18 σ between the simple muscular reaction without disturbance and the same kind of reaction taken while the attention was disturbed.

In connection with these results it may be interesting to notice some others that differ only in one respect. In the experiments which we have just considered the attention was directed as closely as possible to the movement. In the next set it was given to the ticking of the metronome.

Some of the muscular reactions without a disturbance were also taken each day in connection with the others in order to gain a reliable basis of comparison.

¹Brain, 1879, I. 447.

²Philosoph. Studien III. 329.

³Philosoph. Studien VI. 167.

With the attention fixed upon the disturbing sound the result of 50 experiments without disturbance and 100 with disturbance, made on three successive days, was 110σ mean variation, 7σ for the simple muscular reaction and 158σ mean variation, 14σ for the reaction with disturbance. The difference due to the disturbance is 48σ .

Comparing these figures with those obtained when the attention was directed toward the reacting finger, we find that the difference between the time of reaction during a disturbance to which the reactor gave no attention and the time required when the attention was directed to the disturbing sound is 36σ .

Let us now pass to the experiments in which a choice between two movements was necessary. The sounds to which the movements responded were caused in the manner already explained. The first finger of the right hand reacted to the sound of the two weights as they were struck together and the second finger to that of the falling ball.

The disturbing element was the metronome ticking one hundred and twenty times each minute as before.

The results were as follows: Reaction with choice 179σ (mean variation 21σ ; 100 experiments); reaction with choice, but with a disturbance, the attention being directed as closely as possible to the association of stimulus and movement, 197σ (mean variation 25σ ; 100 experiments); reaction with choice, but with a disturbance, the attention being directed to the disturbance, 265σ (mean variation 27σ ; 100 experiments). The lengthening due to the disturbance is 26σ in the first case and 86σ in the second.

If these results be compared with the simple reactions given above, it will be noticed that, unless a choice is involved, a disturbance has much the same effect as in the simple reactions, provided the attention is directed in the one case to the correspondence of movement and sound and in the other to the movement itself. The increase is 19σ in each case.

When the attention is given to the disturbing sound, however, the lengthening of the time is much more marked in the choice series. This is not surprising, because the attention, after turning from the disturbances to the reaction, would lose more time in associating the given excitation with the corresponding movement than in making a single movement already determined. The lengthening is 48σ for the simple reaction as contrasted with 86σ for the choice-reaction.

It is interesting to observe that while the mean variation increases somewhat under the influence of a disturbance, nevertheless the increase is not very great.

During the progress of these experiments the possibility of

distinguishing a little more closely between disturbances suggested itself. The mind seems at times more in unison with certain disturbing sounds than with others. Is it not possible that this will show itself in the reactions? If this is true, clearly we will have no right in the future to speak simply of a "disturbance of the attention," but must first measure its effect in comparison with other disturbances of the same kind, but differing in intensity. In order that this might be tested we arranged a set of experiments with a graded disturbance.

The excitation consisted as before of the two sounds and the response was given with the first and second fingers of the right hand. Five series were taken and the metronome ticked 40, 80, 120, 160 and 200 times each minute in the respective series. Each contained one hundred trials; the only exception is the series with 120 beats, which contained ninety trials. As before, some of each were taken every day and the order was always changed.

The results are shown in the following table:

TABLE II.

Number of ticks.	40	M V.	80	M V.	120	M V.	160	M V.	200	M V.
Dec. 11	201	14	218	15	185	20	202	23	200	19
" "	213	20	198	19			204	13	217	15
" 12	223	33	200	25	185	19	231	18	211	14
" "	210	13	215	32	188	18	215	16	232	25
" "									208	16
" 13	206	22	206	21	202	19	197	20	190	16
" "	203	20	227	14	202	22	194	15	197	17
" 15	199	13	204	11	188	13	197	18	198	14
" "	208	17	211	25	185	12	203	31	200	19
" 16	203	13	210	8	184	28	224	21	205	17
" "	198	13	213	17	204	19	221	15		
Average	206	18	210	19	191	18	208	19	206	17

The experiments were grouped in sets of 10 each in consecutive order; each number in the table thus represents the

average of 10 experiments, the lower line giving the average for the whole hundred.

In almost every case the partial average of the experiments made while the metronome was giving one hundred and twenty sounds each minute is lower than any of the others. In only a few cases is it higher. From the point with one hundred and twenty ticks the reactions are at first longer and then they slightly decrease. It would seem that there is a *point of least disturbance* which may be approximately found by means of the reactions. This point of least disturbance probably differs with different persons. Dr. Coe was not told at what point the metronome was set, though this would partially betray itself in the ticking. The difference found cannot be the result of practice or weariness, as some of each series were taken every day and the order of succession was never the same.

We now turn to the investigations with reference to the sense of sight.

These experiments were carried on during the evenings when it was quite dark. No light was visible except that which at the proper time served as a disturbance. In order that the chronoscope might be read without lighting the room, a small dim lantern was so arranged that a dark paper funnel connected it with the chronoscope.

The light which served as the stimulus was a Geisler tube, through which a current of electricity could be passed. A card-board about three feet high and four feet long was placed upright directly in front of the reactor and at a short distance from him. A large mirror was attached to the front of the card-board and a hole three inches long and one half of an inch wide in the center of the mirror corresponded to a similar one in the card-board. Through this hole the light of the Geisler tube, which was immediately behind the board, could be seen the moment the current passed. When the simple muscular reactions were taken the mirror was not used. For the reactions in which a disturbance was desired the mirror was attached and a tallow candle of the ordinary intensity was placed in such position behind the reactor as to be reflected in the mirror. The hole in the mirror cut the image of the flame so that it was seen above and below the opening.

The first set of experiments consisted of three series: first, the simple muscular reactions in response to a light stimulus; second, the same reactions taken while the reflected light of the candle was flickering across the opening in the mirror and card-board, through which in a moment the light of the Geisler tube would be seen. In the third series an attempt was made to still further disturb the attention by the image of a revolv-

ing card. This card was about ten inches long and six wide and was covered with a few plain figures. It was placed behind the reactor so as to be reflected in the mirror around the opening through which the light of the Geisler tube was expected. A rotating apparatus caused the card to slowly revolve. The candle was used to illuminate the disk. In all three cases glass in front of the Geisler tube colored the light red.

The results are as follows: Simple reaction, 140σ (mean variation, 11σ ; 40 experiments); simple reaction with disturbance by the candle, 148σ (mean variation, 10σ ; 50 experiments); simple reaction with disturbance by the revolving card, 139σ (mean variation, 12σ ; 70 experiments).

The simple muscular reactions of 140σ is a little less than the results gained by Cattell.¹ The difference is readily understood when we remember that Cattell carried on his investigations during the day, and the sunlight reflected from a white surface would probably require more time to come into the consciousness of the reactor than a red light in a darkened room.

A rather surprising fact is that the simple candle flame flickering across the opening in the mirror, was a source of greater disturbance than the revolving card. The reason of this, however, is not difficult to find. The card, though covered with figures, was too monotonous to serve as a disturbance. This may explain the fact that some investigators have found the reactions so little influenced by a disturbance of the attention. The candle distracted the attention somewhat more, because the reactor looked directly at the flickering flame as it fell across the opening through which he awaited the exciting light. In the other series the eyes were directed rather to the image of the card as it slowly turned. Anything so monotonous will hardly influence the reactions, and still less when the reactor has been told to hold his attention closely to the movement to be made.

The three series differ so little that we can hardly say the reactions were affected, especially when we observe that in the case of the revolving card they are, in fact, less than the simple muscular. The mean variation of the three series is about the same.

From these experiments it was evident that some more positive disturbance must be found.

To accomplish this, I replaced the revolving card with another which was of a circular form, twelve inches in diameter. Around the edge of this disk nine holes were cut.

¹ *Philosoph. Studien*, III. 324.

These holes were one and two eighths of an inch long, and sloped from seven eighths of an inch at the top to one half of an inch at the bottom. This disk was attached to the rotating apparatus, and the lighted candle was placed behind in such a position that the flame shining through the holes in the disk was reflected in the mirror. The rotating apparatus was thus caused to revolve so that five hundred and forty flashes of light fell upon the eye each minute.

The results were as follows: Simple muscular reaction to light, 143σ (mean variation, 10σ ; 100 experiments); simple muscular reaction with a disturbance caused by 540 flashes per minute, 171σ (mean variation, 15σ ; 100 experiments). The lengthening due to the disturbance of the attention is thus 28σ .

The reaction time for a sound sensation has been found above to be 102σ and 110σ . The time needed to respond to a sight excitation is thus seen to be about 30σ to 40σ longer.

While we were engaged in these experiments the thought suggested itself of arranging a series of disturbances for the sight which could be compared with those already used for the sense of hearing. It would then be possible to learn through which of these two senses the attention is more easily disturbed. This has before been impossible because there has been no unit of comparison for the disturbances.

The problem was readily solved by means of revolving disks similar to the one just used. Three disks were prepared. The first had only one hole, which was of the same size and shape as those already described. The second contained two holes, one at each end of a diameter, and the third had one at each of the three corners of an isosceles triangle inscribed within the circular disk. The rotating apparatus was so regulated that it revolved sixty times a minute. It was thus possible with the three disks to give 60, 120 and 180 flashes of light each minute.

The results were: simple muscular reaction in response to a visual stimulus, the attention being disturbed by 60 flashes per minute, 195σ (mean variation, 14σ ; 120 experiments); with the attention disturbed by 120 flashes, 197σ (mean variation, 13σ ; 120 experiments); with the attention disturbed by 180 flashes, 190σ (mean variation, 16σ ; 120 experiments).

The time required by Dr. Coe to react muscularly in response to a light excitation was 143σ , as seen above. We now find the time increases to 197σ , with his attention disturbed by 120 flashes of light each minute. We have already learned that the time of reaction for the sense of hearing was 102σ . In the experiments made on the same day, when the

attention was disturbed by a metronome ticking 120 times a minute, it rose to 122 σ . The lengthening of the time on account of the disturbance was thus 53 σ for the sense of sight, and 19 σ for that of hearing. It is thus seen that when the disturbance and excitation affect the same sense, a distraction of the attention through the sense of sight has more influence upon the reaction time than the same grade of a disturbance through the sense of hearing.

When the effects of the various grades of disturbance are compared, it will be observed that 540 flashes of light a minute are less of a disturbance than 60, 120, or 180 flashes. The probable reason is that 540 flashes acted as a steady accompaniment on account of the rapidity of the flashes. That which is constant tends to be monotonous, and this monotony may have deprived the disturbance of a part of its effectiveness.

Before discussing the experiments undertaken to determine the effect of a disturbance of the attention when a choice was to be made in answer to one of two sight sensations, it will be necessary to describe the apparatus which was constructed for this purpose. The question then was, how to prepare an apparatus by which two different excitations could be quickly and noiselessly produced and the order changed without altering the psychical condition of the reactor. A long lever was fastened to an upright support by means of a pivot, and it was arranged so as to work noiselessly. A light frame, containing red glass above and olive colored glass below, was attached to one end of the lever, which was so placed that this frame was directly behind the aperture in the mirror which we have already described. Through this opening in the mirror the exciting light of the Geisler tube would be seen as the current passed. The other end of the lever extended to the experimenter at the chronoscope, who could raise or lower the handle at pleasure and thus bring the end or olive glass in front of the tube. The change could be made noiselessly in a moment. When the disturbance was desired the mirror was attached, as before, to the front of the card-board, and the disturbing flashes of light were seen reflected around the hole behind which was the Geisler tube. A high partition separated the reactor and the experimenter.

The choice was made in response to the excitations of the colors red and olive. The disk which gave 130 flashes of light each minute was used as the disturbing element. This, it will be remembered, was the "point of least disturbance" for the sense of sight. The final results consist of eleven averages, each of which was gained from ten trials.

The results of the first set of experiments are: Time of

reaction with a choice to be made between two movements in response to one of two different excitations of the sense of sight, 258 σ (mean variation, 23 σ ; 110 experiments); time of reaction of the same kind, but with a disturbance of the attention caused by an intermittent light of 180 flashes per minute, 273 σ (mean variation, 25 σ ; 110 experiments). This gives a lengthening of 15 σ as the effect of the disturbance.

The influence of the disturbance as shown in the reactions is thus less than for the sense of hearing under the same conditions. When choice was made in response to one of two sounds, the time was 177 σ and 197 σ , which leaves a difference of 20 σ .

We have already noticed that in the simple muscular reactions when the disturbance and excitation are of the same kind, a disturbance through the sense of sight is more effective than through that of hearing. We now find that when the reactions include a choice the mind is less disturbed in discriminating between sight excitations than between those of hearing. The difference, though slight in itself, is so far the reverse of that which we found characteristic of the simple muscular reactions as to deserve attention.

The psychical processes are the same, whether we respond to a sound or a sight excitation and that which makes up an act of choice does not differ with the sense organ excited. The reason why the muscular reactions in response to a light excitation are more influenced by a disturbance through the same sense than those of sound, while in choice the light reactions are less affected, must be sought then in conditions which hasten or retard these processes rather than in the processes themselves. A large part of our knowledge is acquired through the sense of sight. We are constantly called upon to decide quickly between things that we see, seldom between what we hear. We thus gain a facility in discriminating between objects of sight and in acting according to our decision. This intimate association of sight and movement in choice leads to an ease and rapidity of action which cannot be equaled when the excitation comes to us through another sense.

We are also more familiar with disturbances in our discrimination between objects of sight. In the street many things crowd themselves upon our sight and in the midst of this confusion we are daily called upon to act. It is then not surprising that our more complicated mental processes, when stimulated to action through the sense of sight, are less impeded by disturbances than when the excitation comes to us through another sense. The time of choice in reply to one of two sounds was found to be 176 σ , that in response to one of two sights is 258 σ .

We have now reached the experiments which may be called the "cross sets." In these the excitation and disturbance affect different senses.

In these experiments the excitation was the usual sound of the two weights. The disturbance was the 60, 120 and 180 flashes of light per minute.

The results were: time of simple muscular reaction in response to an auditory stimulus, 123σ (mean variation 8σ ; 80 experiments); muscular reaction to an auditory stimulus, but with a disturbance of the attention produced by 60 flashes of light per minute, 160σ (mean variation 13σ ; 100 experiments); same with 120 flashes, 141σ (mean variation 9σ ; 100 experiments); same with 180 flashes, 148σ (mean variation 11σ ; 100 experiments).

According to my custom I took a series of the simple muscular reactions each day in connection with those accompanied by the disturbance. The result sustains the view that at least a few of the earlier and simpler reactions should be repeated when the more complicated ones are reached, in order that they may serve as a test of the condition of the reactor. The simple muscular reactions average 123σ ; the average as given above is 102σ . In both tables the mean variation is small. The reason for this difference in the results is that the shorter time was gained at the end of a long practice when Dr. Coe had reached his maximum rapidity. The others were taken after a period of over two months, during which time experiments of a different kind were being made.

Cattell¹ found that a facility in reacting once gained was not lessened by lack of practice; v. Kries and Auerbach² held the same view regarding the simple reactions, but maintained that it is not equally true of the more complicated. I am of the opinion that even in the simple reaction, lack of practice will manifest itself in a lengthening of the reaction time, and that other physical and mental conditions can so far affect the reactor as to make it necessary when accuracy is desired to repeat from time to time the earlier and less complicated tests.

In the results last given we find again that 120 intermittent disturbances each minute is the "point of least disturbance." It will be remembered that this fact has characterized all the results thus far in which the excitation was a sound.

Earlier investigation⁴ has led to the belief that the reactions

¹Philosoph. Studien III. 462-489.

²Dubois-Reymond's Archiv 1877, 361.

³Dubois-Reymond's Archiv 1877, 362.

⁴WUNDT, Physiologische Psychologie II. 293, Leipzig 1887.

are more influenced through a disturbance of the attention if the excitation and disturbance affect different senses than when both are of the same nature. These experiments do not sustain this view. When the metronome vibrated 120 times each minute, the reaction time for a sound excitation was 19σ longer than without the disturbance. The time required to respond to a light excitation while the attention was disturbed by an intermittent light giving 120 flashes each minute was 53σ longer than when the disturbance was lacking. In both of these cases the disturbance and excitation appealed to the same sense organ. On the other hand we find that when the excitation is a sound and the disturbance a light flashing 120 times a minute, the reaction time is lengthened by only 17σ . Even if we take the point of greatest disturbance, 60 flashes, the average is only 37σ longer than the simple reactions, and this is still much below the 53σ already found to be the difference in time between the simple light reactions and those made under the influence of a disturbance through the same sense-organ.

An analogous set of experiments was now made in which stimulus was visual and the disturbance auditory. In these experiments the excitation was the flash of the Geisler tube seen through the red glass and the disturbance was the ticking of the metronome.

The results were: time of simple muscular reaction in response to a visual stimulus 159σ , (mean variation 10; 100 experiments); same with a disturbance of the attention produced by 60 beats per minute of the metronome 176σ , (mean variation 10; 100 experiments); same with 120 beats 190σ , (mean variation 12σ ; 100 experiments); same with 180 beats 174σ (mean variation 11; 100 experiments).

If we take the point of greatest disturbance, which was 120 vibrations of the metronome, the time of reaction is 30σ longer than without a disturbance. This again is much less than the corresponding increase when a light served both as excitation and disturbance.

This lengthening of the time when both the excitation and disturbance affect the sense of sight, cannot have been caused by the disturbing light weakening the excitation, because the exciting light was of sufficient intensity to be clearly seen, even when its appearance and that of the intermittent light were simultaneous. Were this the occasion of the difference it would betray itself in an unusually large mean variation. At times the exciting light would be seen more distinctly and the reaction would follow more promptly. That this is not the case a glance at Table XI. will show. The mean variations are very small, considering that the reactions were made under

the influence of a disturbance. They scarcely differ from those for the sense of hearing as given in Table VI.

Besides, if the more noticeable effect of the light disturbance on the sight reactions is the result of a weakening of the intensity of the excitation, why does not the same peculiarity manifest itself in the choice-reactions for the sense of sight? The same weakening of the intensity would occur in the latter as in the former case. We have found, however, from the results given on page 13 that the time of choice in answer to a sight sensation is 258 σ . During the disturbance the reactions average 273 σ , an increase of only 15 σ , and yet both excitation and disturbance were the same lights that we used in the simple reactions. Though we have found (page 11) that 180 flashes was not the point of greatest disturbance, it would nevertheless make more light and so tend more to weaken the excitation than the 120 flashes, which actually proved a greater disturbance. It is evident, then, that the cause of the difference cannot be found in weakening the intensity of the excitation by the disturbance.

The fact seems to be that in simple muscular reactions an intermittent light is more of a disturbance to the attention than a sound. This has been especially noticeable in the earlier experiments (page 12). If we compare once more the results on pages 14 and 15 we find that both 60 and 180 flashes of light in the "cross sets" proved a source of greater disturbance than the same number of vibrations of the metronome. Here the question of the disturbance weakening the intensity of the excitation cannot even be raised as they affect different senses. Under 120 the sound has the greater influence on the reactions. This average, however, is the largest of the three for the influence of auditory disturbances on visual reactions, and if we place it in comparison with the largest for the influence of visual disturbances on auditory reactions, we find still the light proves the greater disturbance.

It has already been shown that a disturbance of the attention does not have the same effect upon reactions which include a choice as upon the simple muscular reactions. In the latter case we have seen that a disturbance of the attention through sight is more effective in lengthening the reaction time than when the disturbance comes through the sense of hearing. On the other hand, whenever the reaction follows a sight sensation, the time of choice is less affected by disturbances of the attention than if the excitation is a sound. This view is strengthened by two series of experiments on reaction with choice, but with disturbance of the attention.

In the first series of the reactions with choice the excitation consisted of two sounds, produced in the manner described un-

der choice in the earlier experiments. The disks served as the disturbance; they gave 60, 120 and 180 flashes of light each minute.

The results were: time of muscular reaction with choice to one of two auditory stimuli, 230σ (mean variation, 20σ ; 100 experiments); the same with a disturbance of the attention caused by 60 flashes of light per minute, 267σ (mean variation, 21σ ; 100 experiments); with 120 flashes, 243σ (mean variation, 19σ ; 100 experiments); with 180 flashes, 255σ (mean variation, 18σ ; 100 experiments). This gives a lengthening of 37σ , 13σ and 25σ respectively.

The next series consisted of reactions to sensations of sight, in which a choice between two movements was involved. The attention was disturbed by beats of a metronome.

The results were: time of muscular reaction to visual stimuli with choice, 266σ (mean variation, 18σ ; 100 experiments); the same with an auditory disturbance of 60 metronome beats per minute, 278σ (mean variation, 20σ ; 100 experiments); with 120 beats, 267σ (mean variation, 19σ ; 100 experiments); with 180 beats, 277σ (mean variation, 17σ ; 100 experiments). The reaction time with choice is thus lengthened to the extent of only 12σ , 1σ and 11σ by the disturbance. Here, as in the previous experiments on sight-reaction with choice disturbed by flashes of light, the time of choice in response to sight excitation is found but little influenced by disturbances. This has been found characteristic of reactions in which a choice is involved. The importance and probable explanation of the fact I have already discussed.

We now turn to several sets of experiments which preceded those which I have thus far given; it has been thought best, however, to introduce them last. In the choice sets the "non-chance" method was used, and it was while engaged in these investigations that the difference between the two methods was noticed.

The purpose of these experiments was to find how the simple "muscular" and the "choice" reactions would vary while the reactor's attention was directed to certain kinds of work. Three tasks were given; 1, repeating a poem already committed to memory; 2, reading an English book; and 3, reading Kant's *Kritik der reinen Vernunft*. The time for the simple muscular and choice reactions under these conditions was learned. The instructions were to fix the attention as closely as possible on the work assigned. I willingly admit that it is impossible to determine how far the instructions are observed in such a case. There are no means by which the amount of attention given to the reaction or to the task can be measured. I am convinced, however, that the direc-

tions were conscientiously followed, partly from my confidence in the reactors and their interest in the investigations, and partly from the fact that at times the reactor failed to respond to the excitation and then excused himself by saying that he was so deeply absorbed in his reading that he did not hear the sound. This occurred while the English book was being read.

The reactors were Prof. A. L. Gillett, of the Hartford Theological Seminary, and Mr. George Mulfinger, also an American. Both of these gentlemen offered valuable suggestions.

The excitation in the four sets was a sound caused in the same way as in the preceding experiments.

The results of the experiments with Mr. Mulfinger were as follows: simple muscular reaction to an auditory stimulus, 102σ (mean variation, 7σ ; 200 experiments); simple muscular reaction while repeating a poem, 183σ (mean variation, 23σ ; 200 experiments); simple muscular reaction while reading English, 196σ (mean variation, 20σ ; 200 experiments); simple muscular reaction while reading Kant, 210σ (mean variation, 27σ ; 200 experiments). The three distractions of the attention caused a lengthening of 81σ , 94σ and 108σ respectively. When Mr. Mulfinger was required to react after a choice, the results were: reaction with choice, 208σ (mean variation, 24σ ; 200 experiments); reaction with choice while repeating a poem, 212σ (mean variation, 24σ ; 200 experiments); reaction with choice while reading English, 216σ (mean variation, 22σ ; 200 experiments); reaction with choice while reading Kant, 217σ (mean variation, 27σ ; 200 experiments). The lengthening due to the disturbances was thus 4σ , 8σ and 9σ respectively.

With Prof. Gillett as reactor the results were: simple muscular reaction, 107σ (mean variation, 6σ ; 250 experiments); simple muscular reaction while repeating a poem, 170σ (mean variation, 16σ ; 250 experiments); while reading English, 179σ (mean variation, 17σ ; 250 experiments); while reading Kant, 197σ (mean variation, 17σ ; 250 experiments). This gives an increase of 63σ , 72σ and 90σ for the three disturbances.

The time of reaction with choice was 235σ (mean variation, 28σ ; 250 experiments), which increased to 270σ (mean variation, 31σ ; 250 experiments) while a poem was repeated; to 317σ (mean variation, 35σ ; 250 experiments) while English was read, and to 357σ (mean variation, 35σ ; 250 experiments) while Kant was read. We find here a lengthening of 35σ , 82σ and 122σ in the three cases respectively.

The difference here is not so marked. In the first case the increase is in favor of the muscular, and in the other two

with the "choice" reactions. It is clear, however, that the complete separation of the two kinds of reactions by which the muscular are placed beyond the influence of a disturbance of the attention, and regarded as purely practiced brain reflex, while the others only come within the reach of psychical disturbances, cannot be regarded as established. I am led to this conclusion, not alone by these latter experiments, but also by all those preceding. A comparison of results shows a different of only 1σ in favor of the "choice" reactions on account of the disturbance. This was for a sound excitation, and is practically no difference. If we examine the results, we find a difference of 12σ in favor of the muscular reactions because of the disturbance, and yet this 171σ is the least of the effective disturbances that we have found for the sense of sight.

PSEUDO-CHROMESTHESIA, OR THE ASSOCIATION OF COLORS WITH WORDS, LETTERS AND SOUNDS.

By WILLIAM O. KROHN, PH. D., Fellow in Clark University.

The first problem of psychology is the study of sensation. A wealth of material comes to the investigator as the deliverance of the various special senses when the several end-organs are appropriately stimulated. But the *pseudo* sensations constitute the subject matter of psychology just as much as those arising from "bona fide" stimuli. Indeed, much light is thrown upon the problems of psychology by following out this line of study and investigation. Some of the most useful as well as the most interesting psychological material comes to us in the form of *pseudo* sensations. Of all the interesting phenomena which fall under this head, the pseudo sensations of sight are the most numerous. The present paper deals with one form of pseudo photesthesia, to wit—that large class of phenomena in which colors are called up in the mind of the subject when certain letters or words are spoken, or seen in print or writing. The term "color audition," so commonly used, does not cover all the cases, for there are instances, as the context will show, in which individuals have these pseudo sensations of color when they *see* words, but *not* when they hear them enunciated. The term we choose as a sort of label for this interesting class of phenomena is that of "pseudo-chromesthesia." Pseudo-chromesthesia is that peculiar faculty of association of the sensorial perceptions, by means of which any primary sensation, or even a purely psychical process can evoke, in the case of certain persons, a false visual sensation of color, constant in the case of the same stimulus with the same person. The phenomena may be of optical origin, i. e., the efficient cause may come through the eye (or the memory image of a visual sensation) of the graphical forms of a letter, a number, a geometrical figure, such as a circle, triangle or square. They are of acoustic origin when the efficient cause passes through the ear or is a memory image associated

with that organ. Thus every noise, every sound perceived objectively, or evoked mentally can arouse these pseudo sensations of color. This is especially noticeable in the case of the human voice, as in public speaking or reading aloud.

A.—HISTORICAL AND DESCRIPTIVE.

The great poetic genius, Goethe, was one of the very first to make reference to this subject, which he does in his *Theory of Colors* (1810). In this connection he refers to the little writing by Hoffman, which was published in 1786, in which a case is cited of a Swiss magistrate and painter who seemed endowed with the power of giving color to sounds. The sounds of the various musical instruments evoked strong color impressions, which were especially vivid in the case of the high notes. Thus the notes of the violoncello seemed to him, indigo blue; clarionet, yellow; trumpet, bright red; flute, dark red; violin, very bright blue; hautboy, rose color; and the flageolet, violet.

The first case of pseudo-chromesthesia to find a place in the medical journals, and the first, as well, to receive a minute description, is that detailed by Dr. George Sachs—a case which occupied a considerable portion of his inaugural dissertation at Erlangen in 1812, written in Latin, and afterwards translated (1824) into German by Schlegel. The person to whose peculiarity he gives so much space was an Albino, and colored the following:

- | | |
|---------------------------|---------------------------|
| 1. Vowels. | 6. Names of cities. |
| 2. Consonants. | 7. Days of the week. |
| 3. Musical notes. | 8. Dates. |
| 4. Sounds of instruments. | 9. Epochs of history. |
| 5. Figures. | 10. Phases of human life. |

His pseudo-color sensations were of three kinds with reference to their origin—optical, acoustic, and purely psychical.

The vowels appeared as follows:

a = vermilion red.	o = orange.
e = rose.	u (oo) = black.
i = white.	ü = white.

Of the consonants:

c = ash.	m = white.
d = yellow.	n = white.
f = opaque white.	s = navy blue.
h = blue grey.	w = brown.
k = dark green.	

Musical notes generally had the same color as the letters which would indicate these notes.

In the case of the numbers:

1 = indistinct white.	6 = indigo.
2 = uncertain.	7 = bluish white.
3 = ash color.	8 = brown.
4 = red.	9 = dark green.
5 = yellow.	0 = pale uncertain yellow.

It is an interesting observation that in groups of numbers of several figures, each group takes the color of the *last* figure, but the tints remained rather distinct without entirely merging into a single color, the figure of a superior order dominating in general. Zero does not change the color of the figures to which it is joined, but does change the general appearance, e. g., 10, 11, 100, 110 and 111 all are white, but they differ in brightness and clearness. This subject had local colors for each of the cities which did not always correspond with the colors he gave to the isolated letters, which, when grouped together, constituted the name of the city. Likewise as to the days of the week. Sunday was white, sometimes slight yellow; Monday, a cloudy white; Tuesday, indistinct tint; Wednesday, yellow; Thursday, green; Friday, obscure white; Saturday, a bluish ash color. It is to be noticed that the colors of this man were not equally distinct or intense, and that he did not perceive in his pseudo photos-thesia all the colors of the spectrum.

Some of the early observations along this line were those of Gautier in 1843. He contributed nothing new, except in recording the fact that he could produce these pseudo sensations of color artificially, in particular by the use of hasheesh.

In 1848 Dr. Cornaz sought to stir up investigations and researches into the matter by publishing a little brochure on the hyperesthesia of colors. His efforts were not entirely fruitless, for very soon after, Dr. Wartmann gave out an abridged description of two cases. In 1855, Joachim Raff, the composer, declared that the sounds of instruments produced color impressions of various kinds. Thus the sound of a flute produced the sensation of intense azure blue; of the hautboy, yellow; cornet, green; trumpet, scarlet; the French horn, purple; and the flageolet, gray. The clearest and most distinct shades were those evoked by the high notes. Also Ehlert in one of his musical letters from Berlin describing one of the symphonies of Schubert, says: "The air in the scherzo is a sunny warmth, and a green so tender, that it seems to me that I breathe the odor of young fir trees."

Chabaliere published some interesting cases in 1860, but

nothing at all new was contained in his little book, and in the same year Vanthier published a little account of his own experiences, in which a certain sound awakened not only a color impression but also an excruciating toothache.

But Perroud, in 1863, was the first man to recognize the physiological character of these phenomena, and also the first to attempt an explanation. The case he records is that of himself, and is of especial interest because it was a case in which the impressions were aroused by *optical* and not by auditory stimulus. His experience with these phenomena did not begin until he was about fifteen years of age, when he began to see certain letters, especially vowels, intimately bound with colors.

With Perroud :

a = orange yellow.

o = canary yellow.

e = bluish or pearl gray.

u (oo) = sombre brown.

i = carmine.

Diphthongs give the sensation of *two* distinct colors, but this is not the case with compound vowels. These form a single tint, a trifle more intense than that produced by a single vowel. V appears greenish, while all of the other consonants partake of the color of the neighboring vowel (irradiation). Figures are also united by him to ideas of color, but less distinct—1, carmine (same as i); 2 and 3, gray; 4, sombre brown; 5, indistinct; 6, green; 7, carmine; 8, canary yellow [might not 8 be two o's? (ø)]. It is a point of great interest that with this person the colors become more intense the further one reads, and the more tired he becomes, as well as the more his attention is concentrated.

Chaballier again took up the matter, and in a more thoroughgoing way, in 1864. His explanation was also physiological like that of Perroud. With him a is a deep black; e, gray; i, red; o, white; and u (oo), sea-green. He observes that, as *printed*, these vowels appear uncolored, and perfectly black, but he could have no mental concept of them without arousing the colors as given above. He describes the consonants as "dead, inanimate and entirely secondary." With him proper names had very vivid colors according to the grouping of the vowels. The color much more vivid than the name. Would often forget names, but never the color of the name. With numbers he noticed that 2 and all numbers terminating in 2 seemed white merging into gray; 5 and all terminating in 5, a vermillion red. The days of the week also had colors as well as the months of the year. Thus, Juin, very red; Juillet, light red; Août, sea-green; and all the "ber" months were an earthy gray

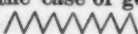
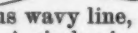
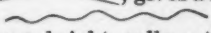
(colored by e). In 1865 Verga observed some new cases and revised Chaballier, and in 1871 Kaiser also observed some new cases, which he treated in his compendium on optical psychology.

Perhaps there is no contribution of more interest than that of Nussbaumer, who, when a student at Vienna, at the age of 23, published his observations and those of his brother. They both possessed the finest discriminative ability for sounds from a very early age. From the age of 4 or 5 years they both experienced the phenomena of color audition. In one of their games they used three spoons with strings attached to make bells, and each tried to excel the other in making sounds, claiming different ones produced this or that color, the discussion always ending in a fight. With these two brothers the perception of color seemed purely subjective. Of the letters they colored the vowels only and not the consonants. With F. Nussbaumer, of the piano sounds, *re* is chestnut brown; *fa* is brown with gray lines; *mi*₂ is sombre brass color at the beginning of the sound and blue at the expiration; *la* is chamois skin yellow; *la*₂ is a clear orange yellow; *fa*₂ is a transparent lemon; *sol* is yellow changing into blue; *do*₂, white at beginning and then changes into transparent light blue. The sound of a rolling carriage is a gray mixed with yellow; that made by a saw is green. The voices of men, if effeminate and sharp, are like the color of a faded leaf in autumn; harsh voices are a brownish gray. The highest tones of a trumpet are a golden yellow and diaphanous; a little table bell, yellow at first and bluish toward the end.

These sensations of color with John Nussbaumer were also of acoustic origin. The high sound of a trumpet gave him the impression of lightning. Other sounds called forth simple tints of color. In 1876 Prof. J. Nuel made a résumé of the facts related by Nussbaumer and set himself to explain them. Of this attempt we shall speak later.

Of all the works on this class of sensations, none is more familiar or more frequently quoted than that of Bleuler and Lehmann. We will cite but one of his cases in detail, and select the one we do because it is a clear case of color hearing. The subject (the 77th) maintains that the form of a letter has but little to do in evoking color impressions, but the least change in the sound or quality of the tone greatly changes the shade of color.

Words learned before he knew his letters, e. g., "millionen," have a single color, while others take their color from the component letters. Of the languages, French is sombre brown; German is green; English, light brown; Italian, bluish; ancient Greek, yellow; and Hebrew a som-

bre tint. Up to this point it is, as stated above, a case of color audition; but when we come to the figures, we find that the various digits evoke color sensations entirely independent of sound, and it thus becomes a case of pseudo-phothesthesia. In the case of geometrical figures, a succession of acute angles, , gives a light tint; a series of obtuse angles, , gives a little darker; and a continuous wavy line, , gives a still darker shade. A circle gives a bright yellow tint, while a triangle gives a clear, bright, silvery image, and the rectangle also a very light color.

The low sounds with this subject were all black, passing as they rise in the scale into a reddish brown and brownish yellow in turn. The middle sounds are yellow and the most elevated are pure white. Surely the "chromatic scale" should possess no terrors for such a man. The noise of respiration is gray. A crackling sound is made up of white points; a tremulous sound is a light bluish gray.

With this subject the color associations transcend the ordinary limits, for he has them awakened by senses other than those of vision and audition. Thus, with the sense of smell there is no odor without a color sensation. A cold in the head changes the color of these odors. The odor of vanilla is a light lilac; of the rose is rose color; odor of ammonia is whitish; of vinegar, red; of cologne at a distance, reddish, but under the nose it becomes a transparent gray. In the realm of taste—a sweet taste is red, a bitter taste is a dark brown; with vanilla the taste evokes the same color as the odor, showing that the so-called sensations of taste are largely those of smell. The painful sensations color themselves according to their intensity: thus, violent pain is white; heavy headache is black; an intermittent sharp pain is made up of white points, the same as a crackling noise; a pinch gives a yellow color. The days and months are also colored, but independent of sounds.

In 1882, Pedrono, the well-known rhetorician of Nantes, published a case of no little interest. He seems to have colored sounds rather than words or letters. These color impressions he describes as sudden and spontaneous. *The sounds are translated into color before he can stop to think whether the voice is high or low.* He externalizes an image hovering round about and above the person singing or producing the noise. Vowels when standing alone give no chromatic sensations, only when uttered, and then they take their color from the tone of voice. In general, low sounds are sombre and high sounds are bright. Every noise, whether a harmony, discord, crash or clang, produces a

chromatic sensation. Of voices, yellow voices are the most agreeable, and fortunately the most frequently met by him. The same melody when played on different instruments gives different color impressions. Upon a harmonium or tenor saxophone it is yellow; clarinet, red; and piano, blue. Whether the person is seen or not the color is there; whether the eye is opened or closed makes no difference.

In his little work published also in 1882, G. Mayerhausen tells of a lady of 25, a wife of a physician, who had some very vivid color impressions, which seemed to be associated with sounds rather than forms. One of the interesting things he relates is that polysyllabic words, if quickly pronounced, give the color of the principal syllable accented; if slowly spoken, each syllable has its own color. The cases related by Francis Galton, in his well-known work, are sufficiently familiar and need only a passing allusion.

The case related by Rochas is that of a lawyer of 57, who, while he likes music, is not a musician. He is a traveller and an accomplished linguist, but has never heard of color audition as a phenomena, but always thought his experience an entirely normal one. He possesses this faculty to a remarkable degree and his impressions are entirely acoustic as to their origin and psychical. He does not exteriorize sensations, but sees, as he expresses it, the color in his brain. Of the vowels *a* is carmine; *e*, white; *i*, black; *o*, yellow; *u*, (oo) azure blue. The consonants are as a rule pale grey. Words take their color from the component letters. The various languages also have their color labels. Thus German, in which consonants predominate, is mouse colored; French, green merging into yellowish white; English is dark gray; Spanish has three colors, in the main, either yellow or carmine, but sometimes a dazzling metallic tint; Italian is yellow, carmine and black. It is with reference to musical sounds that this is a case of especial interest. The low notes are a very dark or deep rose tint; the more intense and higher pass from red to yellow, then blue, and finally black or a deep violet, precisely the order in the spectrum. The order is also according to the number of luminous light vibrations, thus the low notes of few vibrations produce red, while the highest, of many vibrations, cause the perception of violet. In singing the notes by names the vowels give the color. Low voices are of a deep carmine, while high sharp voices are a crude dark blue. Among musical instruments the sound of a bass drum is chocolate; of a trumpet, a brilliant yellow; hautboy, flute or piano, blue; violin and fife, deep violet or glossy black; guitar, gray.

Lauret acquaints us with the case of a man aged 50,

an intelligent scientist of normal vision, no musician, but likes music. His chromatic sensations are of acoustic origin and are always externalized. He fixes the colored image at a distance of one or two meters from his eyes. With him, as is usual in the case of letters, the dominating impression is produced by the vowels. Each image arouses not only a special color but a special form as well. Thus *a* is oval in form on a perpendicular axis of black; *é* and *ê* are squares of a dirty straw yellow color; *i* is a large point of silver white; *o* and *ô* are chestnut red on disks of madder red; *u* is a greenish blue. Diphthongs are colored like vowels: *oë* gives a circle, each half of a different color. Consonants have no influence upon the color of a vowel except in the case of *m* and *n* at the end of a word. Noises are also colored by this individual; thus the noise of the waves (French, *vague*) gives the color sensation of *ou* and *i* together. Deep voices are a dark chestnut if low and pass to light chestnut in louder tones. In singing the color impression produced by the baritone is chestnut passing into yellow; tenor is a deep yellow; contralto, light chestnut; mezzo-soprano, light yellow; soprano, passes into light and lighter yellow ending in a cream. Of the different instruments the clarinet produces in low notes a deep dirty yellow, while in the high notes it arouses a light yellow. The low tones of a flute are yellow, changing suddenly into light blue and then into white; hautboy, chrome yellow; the piano, if played moderately quick from low to high, gives first chestnut, then clear red, wavy yellow, blue, bluish white and white in turn; the violin gives garnet, orange, yellow and white in turn when passing from low to high notes, while in the same way the 'cello gives chestnut passing into carmine.

Prof. Steinbrügge of Giessen informs us of a case that was brought to his attention by an exile German Jesuit in Madeira. It was of a boy of sixteen, who had always lived in one of the country districts of the island, was strong and healthy, unimaginative, lazy and unmusical. His color impressions came spontaneously and suddenly; no time elapsed in which mere association could take place. It was rather a case of perceiving the objects, sounds and noises as actually colored. Fechner also collected a large number of cases, of which 347 were decidedly clear and authentic. Under these we find two of persons totally blind, who never noticed this peculiar faculty until after they became blind, when they possessed it to a remarkable degree. Also the case of a color blind person is cited, but he associated only the colors, known to him, while red was lacking. One lady, who always had color impressions in connection with numbers, proper names and days

of the week from her earliest childhood, wrote in connection with the answer to the list of questions sent out to such persons: "My mother associated other colors and was always very indignant when I maintained that the colors were other than those she gave."

The subject of whom Paul Raymond writes is a man of 30, strong, never been sick, but impressionable and has alternative moods of excitement and depression. From the earliest times he has had these color impressions called up chiefly with the vowels. No musical sounds give him perception of color. Each syllable takes its color from the vowels. The languages are also colored. Thus English is gray; Italian, yellow; German, black; Spanish, blue. But each word takes its color from its component vowels no matter in what language the words are found.

The case related by Grüber possesses nothing especially new. It is a case in which these pseudo sensations can be traced both to acoustic and optic origin. Figures also have colors with this person, and merely by the aid of combinations of colors alone is he able to carry on arithmetical processes.

Of the printed cases in English that which Prof. Holden records of his daughter Mildred is one of the most interesting and thoroughgoing. (Cf. *Nature* Vol. 44 p. 223.) By mere accident he learned of the color associations possessed by his daughter and became intensely interested. He made a record of the colors as associated with letters at six different periods, when she was 7, 8, 10½, 13, 14½ and 17½ years of age, respectively. The agreement of these different lists is most remarkable, showing very plainly that it is not a case of mere memory, but one of vivid and permanent associations. In numbers, 1 is black; 2, cream color; 3, light blue; 4, brown; 5, white; 6, crimson; 7, greenish; 8, white; 9, greenish; 10, brown; 11, black; 12, cream color; 13, blue; 14, brown, and so on. Thus 11 has the same color as 1; 12 as 2; 13 as 3; 14 as 4; 15 as 5, etc. In going over the table we find that G, P, T, Z, 7 and 9 are green; A, H, 5, 8, V and Friday are white; C, O, S, U and Saturday are yellow.

We will not give place here to the contribution of President Jordan, because it has been so recently published and is very familiar to all. In this same article are also detailed some of the interesting experiences of Prof. Spencer, of Moore's Hill College, Indiana. The writer is under great obligations to President Jordan for the hitherto unpublished account of the following three cases. The first two were furnished him by Mr. Launcelot and Mr. Harris, of Lexington, Va., while the latter was received from Miss Woodward, a student in Stanford University. They will be given with the exception of a

few minor changes in the correspondents' own words. The young lady in the first case is about 18 years of age.

My sister, who had been amused at my color associations, jokingly asked Miss Julia B—— the color of A. She replied, "Brown, of course," and was surprised to hear that it did not so appear to everyone. "How could anyone tell whether a name was pretty or not except by its color?" On further examination she gave without hesitation the colors of most of the letters, there being a few the color of which she found difficulty in expressing in words.

A=brown.	J=black.	S=lead-color.
B=gray.	K=green.	T= <i>pale</i> yellow.
C=yellow.	L=brown.	U=blue.
D=gray.	M=green.	V=gray.
E=yellow.	N=green.	W=brown.
F=black.	O=red.	X=lead-color.
G=light pearl.	P=gray.	Y=purple ¹ .
H=black.	Q=green.	Z="gray & brown
I=lead-color.	R=red.	mixed."

She also gave the colors of a number of names of persons, indicating whether they were pretty or otherwise.

About two weeks after this I questioned her myself and found the colors of the letters, which she gave instantly, to be, with one exception,² precisely the same as those on the foregoing page which my sister had taken down. I also asked the color of a number of names of persons and other words. I at once discovered that the word took the color or colors of the vowel or vowels which it contained.³ The color in the accented syllable predominated, and when a syllable was but slightly pronounced, its color was ignored altogether. Thus Ashley is brown only.

The name or word is colored according to its printed or written form, not its sound. Thus *Lila* is yellow and lead-color, while the *ine* in *Josephine* is lead-color and yellow—the former color, however, predominating in each case. When I asked the color of *Goethe* she answered blue, spelling to herself *Gurty*, but on writing the name and showing it to her, she said it was *red* and *yellow*. Yet the sound evidently plays a part, as the following list shows:

Lancy, ⁴ bright brown.	Myrtle, color of y, a beautiful
Lila, bright yellow.	name.
Lina, nearly black.	Larkin, "wine-color brown."

¹Color of crape-myrtle.

²Y given as black in my sister's list.

³Cf. Galton fig. 68, which I have since seen.

⁴Sounded as in Alice—seems inconsistent. The n seems to figure.

Lilly, lighter shade-lead-color.	Alice, dull brown (a hideous
ine in Josephine, Lilly.	name).
Rosa, bright red.	Amy, less dark.
Lula, deep blue.	Lettie, light yellow.
Ulla, lighter blue.	

There are some exceptions to her law for coloring words, the following being those I could discover :

Buck, red.	Will, red.	Mary, green.
*Wirt, wine-color.	Willie, white.	*Cassie, green.
Bird, red.	Ruth, lilac.	Lizzie, green.

All of these except those marked with an * are names, chiefly in her family, with which she was familiar before she knew her letters. The other two, however, she had not heard until recently. Moreover, a number of her family names are colored according to her general law.

It is with names of persons that she chiefly associates color, but she gives the color or colors of any word according to its vowels.

She has three colors for sounds—yellow, red and dark. A high note on the piano, a cricket's chirp are yellow; a low note, a man's deep voice, dark (precisely as with myself). She gives as red a cat's mew, a cock's crow, a man's whistling. A rattle is yellow.

She has no associations for tastes, smells or pains.

The second is the case of Miss Rosa B——. These two young ladies are cousins.

a= brown.	j=lead color.	s= yellow.
b= blue.	k= light brown.	t= yellow.
c= gray.	l= black.	u= blue.
d= lead color.	m= green.	v= gray.
e= yellow.	n= gray.	w= brown.
f= brown.	o= red.	x= black.
g= yellow.	p= yellow.	y= lead color.
h= green.	q= green.	z= gray.
i= lead color.	r= dark red.	

"U" when connected with "H" is always green; if not is blue. The color of a word is generally determined by the vowels it contains.

Names that she was familiar with before she learned her letters are exceptions to this rule.

The third case is in the form of a confession by Miss M——.

I think I must have been about four years old when I began to associate color with words, and it was evidently their sound and not their meaning that aroused the sensation.

Yet I do not remember that letters or numbers conveyed any such impression. Only new words such as I heard for the first time, gave me a distinct idea of color. Family names as well as given names nearly always had some color, and those which had none were soon forgotten by me. I can recall the name of some people in stories told me when I was a child and even now their color accompanies them. Again, I may think of a story and a person in it in whom I was as much or more interested than in those first mentioned, yet I can not think of the name. When the name is told me the color is lacking or indistinct. The same word or name always bore the same color, no matter where it was used.

Words which I had been accustomed to hearing daily had no color. At one time my brother, who could speak French, pronounced the word "encore," but without giving any meaning; it sounded yellow to me and I did not forget it.

I don't think that music was ever accompanied by color, at least not a melody, but I think that certain chords had color. I recall those words as having a distinct color, England, blue; Bertha, blue; Robert, brown; alligator, green; hyena, yellow; Alma, orange; Emma, blue; Charlie, red.

In the April number of the current volume of the *Revue Philosophique*, Beaunis and Binet publish results of their endeavor to measure the reaction time in two cases of color audition. The time indicated is that which elapses between the lettering of a certain letter and the touching of the electric key as soon as the associated color is announced. Even with their imperfect apparatus the time is found to be remarkably short. Thus in one case the average for a is .47"; e, .62"; i, .43"; o, .49" and u, .56", making an average of .51 sec. On the other hand the mean time for the recognition of the letter alone regardless of color was .45 sec. Thus the mean time occupied for the association of color was .06 sec. Phillippe made a series of experiments in which the mean reaction-time for figures alone was greater than for the associated color; for the person to name the figure it took 0.76 sec., to name the color 0.70 sec. The color was always seen before the meaning of the word was observed. In moments of fatigue the color impressions are more intense.

A considerable number of cases have been investigated by the writer, but only one is selected for a detailed statement on account of limited space. It is that of Miss S—, a young lady much above the average in intelligence and very accomplished. The æsthetic element is a prominent factor in her psychic life. She is a skillful musician, having taught in a conservatory of music for some years; very well informed as to literature and is herself a pleasing writer. With her

the color impressions are produced in three ways. First, and chiefly through the graphic forms; second, through auditory stimulation; and third, by means of ideation. It is a complete and fully rounded out case. *All* the letters are colored thus.

A=opaque white.	O=black on white ground.
B=dark cactus green.	P=bright yellow.
C=pale yellow.	Q=Naples yellow (buff).
D=tan color.	R=dark green.
E=warm grey but pale.	S=light green.
F=very dark brown.	T=red; less intense than H or K.
G=yellowish bright tan.	U=gray.
H=red, crimson.	V=pearl—slightly lavender.
I=black.	W=black.
J=black sometimes shades into green.	X=red; still less intense.
K=red—very like H.	Y=yellow into green.
L=black.	Z=brown sometimes shading into an iridescent purple.
M=blue.	
N=gray.	

The numerical digits are also colored. Thus 1 is black like i; 2 is opaque white, like a; 3 is bright green, slightly yellow; 4 is seal brown; 5, black; 6, grey; 7, yellow; 8, pink; 9, brown, lighter than 4. The colors of numbers are often and even generally more intense than those of letters.

In music written in different keys C. D. etc., the music has a general background of color which is the same as that of the index letter indicating the key. Thus music written in the key of D is tan color. All "sharp" keys are brighter and "flats" are less brilliant.

Words pronounced alike but spelled differently have *different* colors. Words generally take their tone of color from the *initial* letter. Thus with the same letters in different combinations we have different color-impressions, e. g., deer=tan; reed=greenish yellow. With this person we find there is an intimate relation between form and color. In grouping several letters of one color we find that H, K, T and X are red; B, R, S and 6 are green; C, G, P, Q, D, tan color; Y and 7 are yellow; Z, F, 4 and 9 are brown; N, U, V, A and E are gray. This fact we will refer to again in an attempt to explain these phenomena.

B.—EXPLANATORY.

Believing that the scientific method is the only legitimate one, we have sought in the first place to present the facts as found before advancing any explanation. The disclosure of

facts is ever the best critique. First describe, then explain is certainly the best law for method of procedure. Before submitting our own view we desire to present a sort of résumé of the explanations already advanced.

Some have sought to find their explanation in the contiguous relations of sensorial centers on the cerebral cortex; in anastomosis between their different nerve fibres; in the reciprocal agitation, motion and disturbance of their individual cells. Others believe it to be due to reflex action and still others attribute it to a confusion of ideas.

Carnaz held that it is a *visual* trouble, a hyperesthesia of the sense of color—pathological and due to some optical lesion. Prof. Wartmann and Dr. Marce also accepted this as an explanation.

Perroud (in 1863) was the first to say that it is not at all a pathological condition, not depending on material lesion, neither constituting an illusion or hallucination.

Chabaliér, while he recognized the physiological explanation of the phenomena of pseudo chromesthesia, does not consider the phenomena as pathological, but allied to a light confusion of ideas and still more regarded it as a sort of psychic perversion, "an illusion belonging to that class of illusions compatible with reason."

H. Kaiser presents the idea that the subject himself puts the color into an intimate relation with the words in order to better engrave these words upon his memory. He says that it partakes then of the nature of association of ideas, going back to the earliest infancy and in virtue of which certain colors would be united to words voluntarily and then by long custom become spontaneous. Schenkel also offers the same as an explanation.

In 1875, Lussana wrote that the sensorial centers of sound and color in the human brain could be contiguous and thus influence each other in perceiving. Prof. Nuel has a kindred view. A year later, 1876, he writes that false secondary sensations might be due to a central nervous irradiation deterring the sensorial afferent currents. And still in the same line Pouchet and Taurieux hold that it is due to an abnormal crossing of certain afferent or sensory fibres. But to this Pedrono objects that, according to the Young-Helmholtz theory, an immense number would have to be turned aside in order to do the great amount of work. This assumes the validity of the theory of Young-Helmholtz. Pedrono himself would rather admit the existence of sensorial cerebral centers located somewhere in the gray cortex and would explain on the basis of the contiguity of the chromatic and acoustic centers. This

explains only a portion of the facts—those of color *audition* alone.

Baratoux, in 1883, states that the chromatic center can be excited, not only by impressions from the retina but by deliverances through the other organs of sense. Is the stimulus always directly carried to the chromatic center or via the auditory fibres at times? He thinks these pseudo sensations of color due to anastomose of fibres, rudimentary in ordinary men, but in certain cases highly developed.

Prof. Steinbrügge maintains that this class of phenomena arises, in the earliest youth perhaps, from direct double perception. In later years the corresponding disposition of the brain which the double perception aroused has been impressed once upon the organic memory so that the associated color returns when the vowel or word is recalled. He says there are two possible explanations:—either the sensory stimulus of one sensory nerve passes to another sensory nerve in the course to the brain and thus reaches a cortical center other than that for which it was headed, or it spreads out beyond the limits of its own proper center, reaching a second center, by means of which a second perception is freed.

Rochas explains by assuming a sort of unconscious connection of cortical cells that have to do with hearing and vision. He adduces the case of Gautier, in which certain excitants, e. g., *hasheesh*, can establish such connections or relations which do not ordinarily exist. *Féré* believes colored vision to be entirely due to the particular tone of the nervous system, which is obtainable by different excitants and presentations. He rejects the theory of anastomosis between the two cortical centers and tangling of fibres. Professor Urbanschitsch considers these pseudo sensations as *reflex* sensorial phenomena.

Prof. Stevens' theory may be taken as a type of that large class who rest entirely upon "psychical association" as basis of explanation, when he says my own explanation of the matter is this: When we are learning to spell we associate certain colors with certain words and those words give us the idea of color. These words may be said to be chromopoetic and this property cannot be dissociated from them. For example, D is associated in my mind with dog, and when I think of a dog it never is a white dog, but always a black one; hence, D is black, I brings up ink and black ink; J, a jug of a brown color; V is a vulture, which I always think of as brown."

Thus there are a large number of investigators who claim that the physiological does not fill the bill, and that the only explanation is to apply the law of association of ideas and

they do it with a vengeance. They ask, why could these phenomena take place in the blind, in the darkness, when the eyes are open or shut, when the appearance of the colored image is equally sudden and spontaneous? But to our mind there are objections just as insuperable against the associational theory. While we cannot accept the purely physiological explanation, we can neither regard the theory of "psychic association" as satisfactory. The facts themselves present difficulties in which such a theory cannot over-ride or surmount. Before making a statement of these difficulties we wish to call attention to the general fact that as yet no settlement has been effected with reference to a theory of color. The Young-Helmholtz theory cannot account for some of the simplest facts, e. g., the phenomena of contrast. The evidence from histology is mainly against this theory. There is a tendency at present to accept a "four color" rather than a three color theory. Hering's hypothesis seems also to involve certain unwarrantable assumptions. His assumption of the "destruction" and "construction" of the visual substance is the most difficult article of his "color-creed" to believe. We adopt the conclusions of von Kries rather than those of Wundt, Hering or Helmholtz. After a careful and painstaking examination he finds it necessary to say that "the photochemical facts compel us to adopt a theory of component elements rather than one of changes qualitatively alike and arranged in a continuous series. Only by aid of assuming the varied combinations of such elements can we explain the phenomena of exhaustion, contrast, the mixing of colors from fundamental color tones and the phenomena of after images. The articulation and adjustment of these combinations we would assign to the central organs. We wish now to call attention to the following facts of pseudo chromesthesia.

In the majority of cases it seems to attach itself to a special condition of the nervous system, as well as to a well developed faculty of the imagination. Very rarely is there a defect of the eye or ear. It is remarkable that the younger Nussbaumer was equipped with a very keen ear, for he was able to distinguish eleven partial tones in a klang without using resonators, and without any practice. To be able to do this, of course, requires not only intact end organs of sense but also perfect condition of the central organs. Most of these phenomena, with notable exceptions, however, date from the early years of the subject. The larger number color sounds, especially speech. Some color *only* the graphic forms of letters. The secondary impression is so intimately bound with the perception that it is impossible to separate the two.

Then heredity plays an important part. It is *very infrequent* that a single member of a family alone experiences pseudo chromesthetic impressions. These impressions of colors become more intense, vivid, and striking when the person is fatigued. The intensity and clearness of these color sensations are different with the right and left eye of the subject. There seems to be a perfect agreement in the testimony to the effect that it is the form or sound and *not the meaning* of the word that calls up the color. To a certain extent these phenomena can be produced artificially by means of drugs, etc. The larger number of the subjects are women, who as a class can hardly be called *introspective*; at least they are less so than men—but they are more observant. These secondary color impressions remain constant in their relation to the primary perception. That is, the same colors are always called up by the same excitant or stimulus. In experiments we have made upon such subjects with view to ascertain the reaction time, we find no measurable difference between the time it takes to announce the letter and to announce its color. Thus with the ordinary "Fallapparat" connected with a Hipp chronoscope, you expose the letter D. It takes no longer for the subject to say "tan-color" upon seeing this object than it does to say "D." There are *very few* exceptions to this rule. Indeed there are many cases in which the color is recognized before the letter or figure.

To us it seems plain that the theory of "psychic association" cannot account for all the above facts even if it may be satisfactory as an explanation in a few cases. We must, for sake of convenience, divide the phenomena into two classes. (1) Those that occur within the limits of the same sense, pseudo chromesthesia of optical origin, and (2), those phenomena which find expression in a different sense from the one primarily excited, for example—color audition. In no case would we feel warranted on the basis of our present knowledge in attributing these phenomena to the retinal elements—to the rods and cones—though there is a temptation to do so, especially in those cases where similar graphic forms produce similar color impressions. It may be that in some cases the phenomena could be rightly attributed to the crossing of certain afferent or sensory fibres. Pedrono objects to this by saying that it would take such a large number of such fibres. He seems to be ignorant of the fact that the number of optic fibres alone is between four hundred and thirty-eight thousand (Salzer) and one million (Krause). The optic nerve fibres lie in layers, but in the region of the *macula lutea*, they are finer and in fewer layers and anastomose freely. The rods and cones, it may be said in this

connection, are estimated to be seven times as numerous as the optic nerve fibres.

While it may be that a few of the cases can be best accounted for by applying the theory of psychic associations as in the case of number forms, we are inclined to attribute the majority of cases to the cerebral centers themselves and only on the basis of the facts involved. We might even say that the majority of those cases regarded as purely "psychic" can, in the last analysis, be traced to causes most intimately related to the cerebral centers themselves. For example, in the case instanced. Did Prof. S. come to regard D as black because he thought of a black dog, or did he think of a black dog because the letter D appeared black, and thus, as the initial letter, gave the color to the word? Why are there no cases of *dissociation* of these color impressions, as is often the case with purely psychical associations, such as some of the number forms? Paul Raymond instances certain clinical cases which go to show that there is a close relation or connection between the cerebral centers. It must also be remembered that, *anatomically*, almost every pathway is open to all the incoming impulses, and that the cerebral cortex is a physiological continuum made so by the so-called "fibers of association." The auditory and visual centers are the closest to each other of any of the cortical centers on the brain surface. As to whether there is any such thing as a "chromatic center" we know only the following: With reference to the perceptions of light, color and form, it occurs, of course, that the loss of light perceptions necessarily involves the other two—but either of these alone—form or color may be lost independently. Noyes cites a case from Graefe's Archiv of a person who could read words, but not count figures. The hemianopic loss of sight had respect only to perception of form, but not to perception of light. There was also a slightly reduced color sense in the remaining half of the fields. We know that the centers for light, form and color sense are all in the cortex of the occipital lobe. Wilbrand and Rheinart place them one above the other; the light sense external, form sense intermediate, and color sense internal. Sequin, Verry and Nothnagel think them to be side by side. It can easily be seen that in any case the nervous afferent impulse could either by increased intensity, inhibition or irradiation call up a secondary impression. This relation is more frequent, when not within the limits of the same sense, between color and sound, because these centers are adjacent. On this so-called physiological basis we can explain those cases artificially produced as well as the intensifying of the color impressions

through fatigue. In other words, in such cases, the amount and nature of the blood supply has undergone a modification. After going carefully over the data furnished by several hundred cases of persons who possess the faculty of pseudo chromesthesia, we sum up our position as follows: Some few may depend somewhat upon the association of *ideas* dating from youth, developed in a manner conscious or unconscious, and thus ordinarily we may be said to arrive at the coloring of the days of the week, epochs of history, etc., similar to the phenomena of number forms. Even such are called "*automatic associations*." What is the real difference between perceptions through a sensation and one through an "*automatic association*?" In adult life we have no such thing as pure sensation. The content of our perceptions is supplied by the afferent impulse and the reproductive brain processes aroused. Every perception of a thing or quality is the sensation plus remembered sensations,—generally, organically or physiologically remembered—at least the process is a sub-conscious one. In the greater per cent. of cases the pseudo chromesthetic phenomena arise from some sort of cerebral work which is the outcome of the close relation of the cortical centers, which are connected by numerous associational fibers; notably the visual and auditory centers. Whether this is done by anastomosis of fibres or irradiation, or by direct stimulus of the fibres of associations, it is evident that in some cases at least it takes place within the centers themselves. It is a notable fact that the weaker the color impressions the more "*psychic*" and "*ideal*" it seems. There are still other cases which would have a certain analogy with optical illusions and still others that partake more of the nature of hallucinations.

The writer will continue his psychometric as well as other close tests and publish tables later.

BIBLIOGRAPHY.

- | REF.
No. | TITLE. |
|-------------|---|
| 1. | HOFFMAN, L. "Versuch einer Geschichte der Malerischen Harmonie überhaupt." Halle, 1786. |
| 2. | GOETHE. Theory of Colors. 1810. |
| 3. | SACHS, G. T. L. Inaugural Dissertation. Erlangen, 1812. |
| 4. | SCHLEGEL. Neue Materialien für die Staatsarzneikunde. Meiningen, 1824. |
| 5. | GAUTIER, TH. La Presse. July 10, 1843. |
| 6. | KELLER, G. Züricher Novellen. |
| 7. | CORNAZ, CH. A. Des abnormités congénitales de jeux et de leurs annexes. Lausanne, 1848. |
| 8. | ANONYMOUS. Oppenheims Zeitschrift. 1849. Band XL. Heft. 4. |

- | REF.
No. | TITLE. |
|-------------|--|
| 9. | WARTMANN. Deuxième mémoire sur le daltonisme. Geneva, 1849. |
| 10. | CORNAZ, CH. A. Annales d'Occultisme. 1851, No. 1. |
| 11. | MARCE, L. V. Des Alterations de la Sensibilité. A Thesis. Paris, 1860. |
| 12. | VAUTHIER. Gazette des Hôpitaux. 1860. |
| 13. | PERROUD. Mémoires de la Société des Sciences Médicales de Lyon. 1863. |
| 14. | CHABALIER. Journal de Médecine. 1864. |
| 15. | VERGA. Archiv. Ital. malattia nervosa. Milan, 1865. |
| 16. | KAISER, H. Compendium der Phys. Optik p. 197 note. |
| 17. | KAISER, H. Association der Worte mit Farben. Archiv für Augenheilkunde XI. 96. |
| 18. | LUSANNA, F. Fisiologia dei Colori. Padone, 1873. |
| 19. | NUSSBAUMER, J. A. Ueber Subjectiv Farbenempfindungen u. s. w. Vienna, 1873. Med. Wochenschrift. Nos. 1. 2 and 3. |
| 20. | BENEDIKT. Mittheilungen des Ärztlichen Vereins in Wien. Vol. II. No. 5. p. 49. |
| 21. | NUEL, J. Dictionnaire Encyclopédique des Sciences Médicales. Vol. 83. Article on the Retina. |
| 22. | WUNDT. Physiologische Psychologie. 1874. pp. 452, 668, 850. |
| 23. | POUCHET AND TOURNEUX. Précis d'Histologie Humaine et d'Histogénie. 2nd edition. 1878. |
| 24. | GALTON, F. Nature. 1880. Vol. XXI. 252. |
| 25. | BLEULER and LEHMAN. Zwangmässige licht empfindungen durch Schall u. s. w. Leipzig, 1881. |
| 26. | SCHENKE. Beiträge zur Association der Worte mit Farben. No. 48 Prag. Med. Wochenschrift. 1881. |
| 27. | PEDRONO. De l'Audition Colorée Annales d'Occultisme. Nov. and Dec. 1882. |
| 28. | MAYERHAUSEN. Ueber Association der Klänge, speciell der Worte mit Farben. Klinische Monatsblätter für Augenheilkunde. Nov. 1882. Page 383. |
| 29. | AGLAVE, EMILÉ. De l'Audition des Couleurs. Recueil d'Ophthalmologie. 1882. No. 9. |
| 30. | SCHENKE. Ueber Association der Worte mit Farben. Prag Med. Wochenschrift. 1883 X. 94 and XI. 101. |
| 31. | DE PARKVILLE, HENRI. Association of Color with Sounds. Pop. Sci. Mon. Vol. XXIII, 490. 1883. |
| 32. | GALTON, FRANCIS. Inquiries into the Human Faculty. pp. 145 ff. MacMillan & Co., 1883. |
| 33. | BARATOUX. Revue de Laryngologie. 1883. No. 3. |
| 34. | STINDE. Vom Feld zum Meer. Mch. 1883. |
| 35. | GRAZZI AND FRANCESCHINI. Balletino delle malattie dell' orecchio. May and July, 1883. |
| 36. | BARREGI. Gazzetta degli Ospedali. 1883. No. 50. |
| 37. | LUSANNA. Gazzetta Medica Veneta XXVI. No. 39. Giornale internaz. delle Sci. Med. 1884. No. 9. |
| 38. | UGHETTI. La Nature. Milan, 1884. |
| 39. | VELARDI. Giornale internaz. del Sci. Med. 1884. No. 7. |

- | REF.
No. | TITLE. |
|-------------|---|
| 40. | FILIPPI. Di alcuni fenomeni prodotti dai suoni musicali, etc. Florence, 1884. |
| 41. | HILBERT, RICHARD. Ueber associ. Geschmacks und Geruchsempfindungen mit Farben u. s. w. Separat Abdruck d. Klin. Monathl. für Augenhellkunde. Jan. 1884. |
| 42. | HILBERT, RICHARD. Article in L'Intermediaire des chercheurs et des Curieux. June 25, and Sept. 25, 1884. |
| 43. | HOLDEN. Science, Vol. VI., p. 252. 1885. |
| 44. | DE ROCHAS, A. La Nature. April 18, 1885. No. 620. |
| 45. | DE ROCHAS, A. La Nature. May 30, 1885. No. 626. |
| 46. | DE ROCHAS, A. La Nature. Oct. 3, 1885. No. 644. |
| 47. | GIRONDEAU. L'Encéphale. Sept. and Oct., 1885. |
| 48. | LAURET. Gazette Hebdomaire des Sci. Med. Montpellier, 1885. Nos. 46 and 47. Gazette de Med. et de Chirurgie. 1885. No. 52. |
| 49. | LAURET. Annales des Maladies del' Orielle. 1886. No. 4. |
| 50. | LAURET. Revue générale d'Ophthalmologie. 1886. No. 7. |
| 51. | FERÉ, CH. Soc. de Biologie. 1886. 384. |
| 52. | STEINBRÜGGE. Ueber Secundäre Sinnesempfindungen. Wiesbaden, 1887. |
| 53. | FERÉ, CH. Soc. de Biologie. 1887. IV. 791. |
| 54. | FERÉ, CH. Le Bulletin Médical. 1887. No. 83. |
| 55. | FERÉ, CH. Le Bulletin Médical. 1887. No. 87. |
| 56. | BARATOUX. Ueber das Farbenhören. Prag Med. 1888. Also De l'Audition Colorée. Paris, 1888. |
| 57. | FECHNER. Vorschule der Ästhetik. I. 176 and II. 315 ff. |
| 58. | Revue générale de Ophthalmologie. 1888. No. 3. |
| 59. | Revue de Laryngologie. 1888. No. 6. |
| 60. | DAREIX. Gazette Médicale de l'Algérie. 1888. Nos. 3 and 4. |
| 61. | GRÜTZNER. Ueber den Einfluss einer Sinneserregung auf die übrigen Sinnesempfindungen. Deutsche Med. Wochenschrift. 1888. No. 44. |
| 62. | URBANTSCHITSCH. Pflügers Archiv. 1888. Vol. XLII. 154. |
| 63. | RAYMOND. Gazette des Hôpitaux. 1889. No. 74. |
| 64. | LICHTWITZ. Le Bulletin Médical. 1889. No. 3. |
| 65. | GRÜBER. Congtes inter. Physiologie Phys. Paris, 1889. |
| 66. | DE VARIGNY. Same. |
| 67. | BENEDICT AND NEIGLICKI. Same. |
| 68. | ALBERTONI. Ueber Beziehungen zwischen Farben und Tönen. Centralblatt für Physiologie. 1889. III. 345. |
| 69. | RAYMOND. L'Audition Colorée. Gazette des Hostanz. 1890, July. No. 2. |
| 70. | London Musical Times. Nov., 1890. |
| 71. | WAHLSTEDT. Two cases of color hearing. Verhandl. des biol. Vereins in Stockholm. 1890. III. |
| 72. | SUAREZ DE MENDOZA. L'Audition Colorée. Paris, 1890. |
| 73. | FLOURNOY. Sur l'Audition Colorée. Archiv des Sci. Phys. et Nat. 1890. XXIII. 352. |

- | REF.
No. | TITLE. |
|-------------|---|
| 74. | NIMIER, H. L'Audition Colorée. Gazette de Med. et Chirurgie. No. 12. 1890. |
| 75. | QUINCKE. Ueber Mitempfindungen und Verwandte Vorgänge. Zeitschrift f. Klin. Med. 1890. XVII. 5. |
| 76. | SPENCER, EDW. Word Color. Proceedings Indiana College Association. Pub. in Dec., 1890. |
| 77. | Annales des maladies d'Orielle. 1890. No. 1. |
| 78. | Revue général d'Ophthalmologie. 1890. No. 3. |
| 79. | PRESIDENT JORDAN. The Color of Letters. Pop. Sci. Mo., July, 1891. |
| 80. | STEVENS. Colors of Letters. Pop. Sci. Mo., Mar., 1892. |
| 81. | Revue Philosophique. April, 1892. 448 ff. |
| 82. | Article on Color Hearing, vid. Hearing, in the 1881 Annual of Appleton's Encyclopedia. |
| 83. | MILLET. Paris, 1892. A pamphlet on Audition Colorée. 81 pp. |
| 84. | BINET AND PHILIPPE. Revue Philosophique. April, 1892. |
| 85. | Cf. EMERSON Correspondence in Atlantic Monthly. June, 1892. |

REPORT OF AN EXPERIMENTAL TEST OF MUSICAL EXPRESSIVENESS.

BY BENJAMIN IVES GILMAN.

(Continued from last number.)

The opinion which has been the starting point of this experiment is that music is a form of language, a vehicle by which thoughts and feelings may be transmitted from one mind to another. Musical compositions are said to be the texts which he who listens may read. In other words, a piece of music has, according to this view, a power to engender a more or less specific frame of mind and heart: this being its burden, message, import, or what it expresses.

In attempting to apply a test to the opinion thus formulated, our first business must be to decide upon what we shall take such phrases as these to mean; for they are far from constituting a definite doctrine. The general notion which lies at the basis of them is evidently that of the resemblance of the mental state of different hearers of a piece, or the same hearer on different occasions by more than the content of the auditory perceptions. Meaning by an individual instance of a certain music a certain occasion of the occurrence of a certain mass of auditory perception to a certain hearer, what we shall call an individual impression from a music will be the content of imagination and emotion entering into an individual instance of it. By a body of agreement or simply an agreement about a piece, we shall mean an element common to several individual impressions from it; and by a prevalent agreement, an element common to a majority of impressions. We shall here assume that any agreement which tends to be prevalent about a piece enters into its burden of expression. That is, whatever elements of feeling or fancy we have reason to think would, by taking more and more impressions, eventually prove to enter into a majority of impressions about it, will, taken together, constitute its probable burden of expression.

Our reason to think this of any element of spiritual content will emerge in a comparison of whatever impressions we can

ERRATA IN ARTICLE ON MUSICAL EXPRESS-
IVENESS.

P. 44 l. 2, from top: for "apperception" read "appreciation."

P. 44 l. 5, from top: for "the auditory" read "this auditor's."

P. 47 l. 16, from bottom: for "of Beethoven Prelude" read "of the Beethoven Prelude."

P. 50 l. 15, from bottom: for "(of *E*)" read "(cf. *E*)."

P. 51 l. 25, from bottom: for "or morning" read "of morning."

P. 54 l. 9, from bottom: for "cloisterers" read "cloisters."

P. 56 l. 2, from top: for "B sharp" read "B natural."

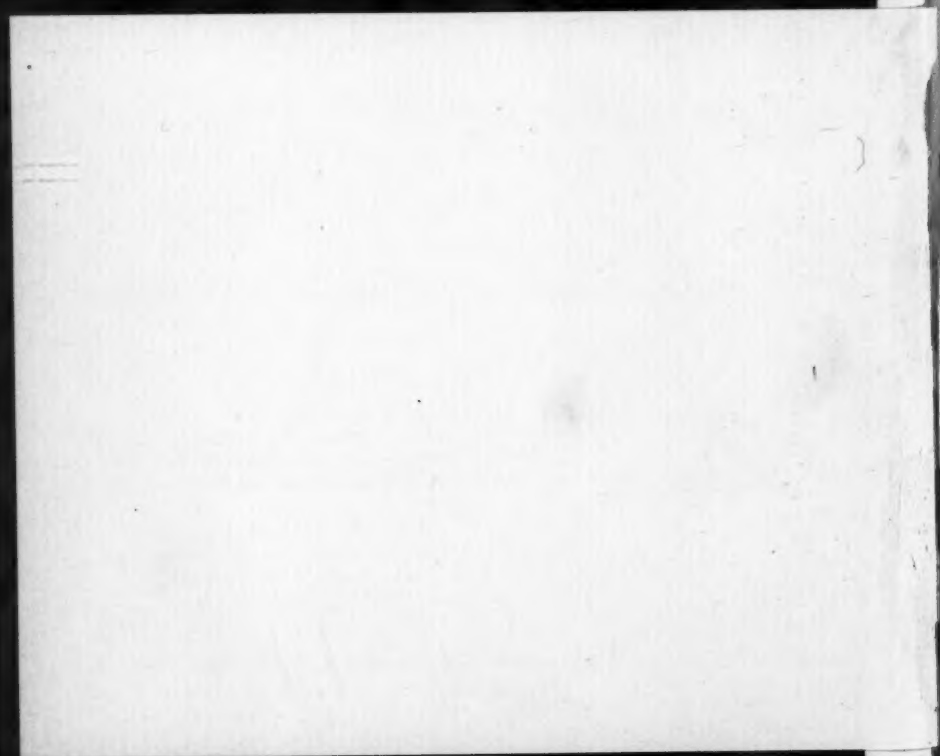
P. 58 l. 1, from top: for "devoted" read "most devoted."

P. 59 l. 1, from top: for "d b" read "d flat;" for "b sharp" read "b natural;" and for "e sharp" read "e natural."

P. 63 l. 3, from top: for "acknowledged it in" read "acknowledged in it."

P. 65 l. 7, from top: for "cast out" read "has cast out."

P. 69 l. 22, from top: for "cause" read "a cause."



obtain of the given piece. Left out of the comparison altogether, we may assume, by the terms of the definition of expression, will be, first: the impressions of inattentive hearers, for in these cases no auditory perceptions exist, in the sense of *grasped* content of sound; and second, those cases in which the attention of the hearer is altogether absorbed by his auditory perceptions, for here no impression exists of which an account can be given. Certain impressions of attentive hearers having been obtained, the next step will be to ascertain by comparison what prevalent agreements exist between them. These hypothetical elements of the expression of the piece must then be tested by drawing new impressions into the comparison. Any hypothetical element which prevails also in the new collection of instances, gains through that confirmation the rank of a probable element of the expressiveness of the piece; any found among the minority only becomes through this fact a discredited hypothesis.

An agreement which is dependent only upon particular experiences of the auditors would certainly disappear in the long run, and may be thrown out at once. This would eliminate any agreement which could be ascribed to external associations with the music; such as those arising from its occurrence, or the occurrence of music like it, on special occasions, or at special places, or in connection with special things or events. Here belongs the requirement that the selection which is to be the subject of a test must not be *recognized*, else such associations (its name, the words that go with it, the dramatic situation for which it was written, etc., etc.) will give it an adventitious expressiveness. In this category are to be placed agreements caused by the communication of the spiritual state of one auditor to another. Any consensus caused by word or sign, or by the knowledge in any way received of the interpretation given by another, would be ephemeral, and is discredited in advance. Although the auditors may strive to disregard all such influences, it is a feat of introspective chemistry of which, doubtless, none are capable to dissociate their external accretions from the rest of the spiritual state. In searching for the expression of a piece, the aim should be to select the impressions of those auditors only to no group of whom such knowledge about and associations with a piece are common.

It may be that an inquiry like the present will bring to light certain conditions of mind, or certain types of mental structure, among instances of which the expressiveness of a music is more fully and distinctly felt than under other conditions and by other minds. One psychical element, which it seems antecedently very probable would increase the ex-

pressiveness of a given music to its possessor, is that of apperception, enjoyment of the auditory content presented. This may in part be an effect due to the attention, which, without interest in a music, would tend to desert the sound and reduce the amount of coincidence between the auditory impression and those of others toward that of any juxtaposed individuals. The impressions of those who do not enjoy a piece would, in so far as this is true, fall under the head above referred to, of inattentive states of mind, not to be called impressions. The effect may in part also be due to the fact that an enrichment of the mood of mind, a more prolific development of feeling and fancy takes place under the awakening and stimulating effect of auditory pleasure. If this is not to exhaust the matter, if apart from attention and excitement the enjoyment of a piece makes it more expressive to the listener, the fact is interesting and piques the curiosity. In regard to mental type. It is said, and doubtless with reason, that certain persons possess, and others lack, "a sense for the language of tone." A vague phrase like this being of no use whatever in any exacter inquiry, we are again obliged, in order to have something to test, to invent a definite meaning for it, as we did in the case of expressiveness itself. This will be the following: An auditor possesses a sense for the language of tone, or is specially sensitive to musical expressiveness when his impressions are a better indication of the probable expressiveness of a piece than are those of others. To express this more fully, the probable expressiveness of various pieces being determined by finding prevalent agreements about them, the examination of the degree of fullness and clearness with which a given burden is reflected in the impressions of a given listener, extended to various listeners and various expressive pieces, may reveal the fact that this degree tends to be markedly higher in the case of some than in the case of the rest; by which is meant that, comparing impressions from more and more pieces, the average of completeness and clearness with which their burdens appear in the impressions of certain listeners will eventually be found much higher than the same average in the case of the others. In default of any convincing evidence of the existence of such a class we can only make surmises as to the peculiarity of mental structure which may be its distinguishing mark. We shall, nevertheless, postulate some connection between this characteristic and powers of musical invention in so far as to assume that composers of rank possess it; that is, we shall assume that the type of mind which is capable of creating structures of tone which the world recognizes as beautiful, will also be specially sensitive to the expressiveness of such creations.

As to the general nature of our inquiry we conclude, then, that its aim should be to find prevalent agreements among impressions from music: these when verified becoming the probable expression or import of the piece in question. Only the impressions of auditors neither inattentive to nor absorbed in the music are to be relied upon in the test. The auditors are further to be independent listeners, who do not recognize the music nor together associate it in any way with particular experiences. We are prepared to restrict our attention to impressions showing an enjoyment of the music played, and to find indications in the replies that there may in different individuals exist a difference of capacity to detect the expressive burden of music.

These logical requirements of the present inquiry we have endeavored to meet first by making our experiment the test of certain hypothetical conclusions as to the expressiveness of certain fragments of music based on opinions already expressed in regard to them. In general this preliminary evidence is the interpretation of a single auditor and may be looked upon as his prevalent impression formed from repeated hearings of the piece in question. To some extent these conceptions are very likely the result of association, due to the auditor's knowledge about the various selections: to what extent their comparison with the replies will give an idea. If the evidence here presented be thought hardly more than suffices for the formation of hypotheses as to the burden of the selections in question, at least the first step has here been taken toward providing an inductive basis for an opinion upon the matter. In the second place the listeners have been chosen for the most part among those specially interested in music; what the selections were has not been divulged to them, and they have been requested to signify the fact of any recognition of the pieces and to refrain from any communication with one another about them.

Independently of the general popular belief in the expressiveness of music, and in advance of a special investigation like our own, we have good reason to think that at least general forms of prevalent agreement tend to some extent to emerge among the impressions of different listeners to the same piece. The mechanism of the influence of tone in the psychical life is largely a mystery (e. g., its effects upon animals and nervously weak people), but there is one form of its working we *can* understand and from which a certain expressiveness seems very naturally to follow. A piece of music is a flow of sensation having certain characteristics which suggest other like things, and those would often in different minds be broadly similar. The illustration nearest

at hand is that of a decided double rhythm of accent marking equal lapses of time. This bears a general resemblance to the rhythm of ordinary human locomotion and its presence in a music, we may be sure, will make images akin to this present themselves very generally in the minds of listeners. So a marked triple rhythm will suggest ideas nearly or remotely like those of leaping and dancing. In the sphere of emotion there exists one specially marked instance of a prevalent effect. Whether the connection between the interval where ratio may be expressed by the fraction $\frac{2}{3}$, and the emotion of melancholy is to be explained as a recondite case of suggestion by similarity or in some other psychological way, or must be accounted for by nervous laws, is as yet undecided : but the connection itself is unquestionable. This interval is about $\frac{2}{3}$ of a tone less than another harmonious combination of pitch, viz., the interval $\frac{3}{4}$. Both are called Thirds (the name growing out of their span of notes in the diatonic scale), the interval $\frac{2}{3}$ being called the lesser and $\frac{3}{4}$ the greater Third. But so intimate is the connection between the lesser Third and feelings of sadness that the adjective "minor," by which the interval is known in English, has been taken up in our common speech as a synonym of "sorrowful." The phrase "a minor strain" often contains no reference at all to the interval of the lesser Third, meaning simply a strain of sadness, a strain engendering melancholy emotion. Some real expressiveness, therefore, we may assume that there undoubtedly is in musical forms. An inquiry in regard to the opinion which has been our starting point is accordingly to be viewed as an attempt to determine the limitations of a power of tone in the spiritual life of whose existence in some form we may feel assured in advance.

Let us now see how it fares with the opinions we have gathered about the different selections of music constituting our programme when confronted with the evidence furnished by our company of listeners. And first, it is to be remarked that as determined by its permanent record a piece of music may be said to be only a general scheme of auditory content of which the concrete embodiments given in different performances may differ very considerably. What we are here testing is the expressiveness which resides in these general schemes of sensation, determined by the printed record of music and not the expressiveness which compositions may have under the hands of special performers. The plan of a structure of tone left in Beethoven's Mss. of the Sonata Pastorale, may have been carried out in the performances from which Gurney received his pronounced impressions of passionate movement in a way differing in important charac-

teristics from that chosen in the performances which our listeners heard. Whatever negative results emerge from our experiment are therefore to be interpreted as indicating that it is not in the printed page that the supposed burden of the music resides—whether in a given rendition or not it would require further experiment to decide. It may be mentioned that the understanding with the performers was that the rendition should be to use the technical terms “objective” rather than “subjective”—that is, they should take no liberties with the text and should not be governed by any ideal or emotional mood unwarranted thereby. Further, the expressions of opinion on which the questions were based were purposely kept from their knowledge. A second point should here be noted. Only in the five pianoforte selections (I. III. IV. V. VIII.) can even the recorded scheme of tone, that is, the piece as written, be said to have been exactly reproduced at our concert. In the six vocal selections (II. VI. VII. IX. X. XI.) the voice was represented by the violin and the accompaniment, if at all by the piano. In these cases the test is then of a somewhat different texture of tone from that of which the selections as recorded consist, and on which the preliminary evidence was presumably founded. The instances in which a more ambitious representation was attempted proved comparatively barren of result and are not included in our evidence. Let us now proceed to an analytical comparison of the notes on each piece judged, both among themselves and with the utterance on which the question was founded.

I.

My conception of the burden of Beethoven Prelude may be analyzed as follows: (a) amid deep gloom; (b) intense labor; (c) repeatedly; (d) directed; (e) toward a single achievement; (f) without progress.

(a) No one except, perhaps, *I*, agrees with me in finding the piece *deeply gloomy*.

According to nearly half the listeners it is more or less tinged with depressed emotion, viz., *M* (melancholy); *E* (disheartening); *B*, *D*, *J*, *K* (sad); *E*, *G*, *J* (unrestful); *P* (yearning); *H* (regretful); *A* (weird). It is apparently neutral to *H*, *L*, *F* and *K*, and either serene or buoyant to *I*, *F*, *N*, *O*, *P*, *A*, *C*, *D* and *L*.

(b) No one states as unequivocally as *I* the *intensity* of the energy involved, although the notes of *E*, *L*, *M*, *A*, *E*, *G* and *I* may be conceived to imply it.

It is especially noted as *mild* energy by *A*, *H* and *O*.

To F, D, K, H and L the images suggested can hardly be said to have involved activity at all.

(c) All of the twenty listeners to whom the piece unequivocally signified activity, regarded this as *repeated* (I take it waves were present to A's mind).

This idea of the aggregation of like elements is lacking in the impressions of the other five, F, H, H, L and K, the latter especially remarking that the structure of the piece is organic and not that of accretion.

(d) These twenty listeners gave eight judgments affirming the activity to be *purposive*: so E, J (argument); H (parting branches); O (fashioning); L (conquest of an opposition); M (struggles of life); D (successful energy); E (flight against wind).

In fourteen it is without purpose: so E, P (dance); A (tree-tops); B and I (chimes); P, C (brook); J, N, A, F, G, I, K (waves).

(e) Of the eight who find the suggested activities purposive, but two agree with me in thinking them attempts at a *single achievement*: so L (conquest of an opposition); and E (flight against wind).

They are two antagonistic efforts to E and J (argument); successive steps in a labor to O (fashioning); and D (successful energy); successive achievements to H (parting branches); successive struggles to M (career).

(f) The twenty listeners to whom the piece expresses activity give fifteen judgments, agreeing with me that the activity is *without progress*; or at least arrives nowhere: so A (swaying); B, I (chimes); E (argument indecisive and dropped); H (advance, but no arrival); J, N, F, G, I, K (waves); E, P (dance); E (flight against wind); P (brook).

They give nine judgments affirming progress: so E (torrent); L (opposition conquered); O (fashioning); A (haven); C (brook); D (successful energy); M, G, J (peace).

Besides the agreements thus far mentioned, there is in the notes another which deserves notice.

To several listeners the piece brings the suggestion of a church and its chimes or organ: so B, I (church and funeral); D (organ); I, P (opening of service); L (wedding; organ). This is doubtless due to the polyphonic character of this prelude (which two listeners thought was by Bach), organ compositions having commonly such structure. These ideas are accordingly special *associations*, and are to be thrown out in a quest after the real intrinsic import of the piece.

The various elements of my notion about this music have stood the test of comparison with those of others in the following way:

(a) Deep gloom. The opinions are about equally divided as to whether the piece is bright or dark in emotional tone. The indication accordingly is that, although in a minor key, it has no pronounced emotional tone. This is noticeable.

(b) Intense energy. The fact that some notes can be interpreted as suggestions of strong activity, while to others it is expressly stated as mild, and the rest seem to regard it as moderate, is an indication that the piece does not, in reality, express any particular degree of energy.

(c) Repetition. A large majority recognize this element.

In regard to (d) purpose or no purpose, (f) progress or no progress, it can be made out that the negative alternative prevails in both cases. This indicates that the element of purpose [and hence (e) determination of achievement] probably is not, and that the element of absence of any progress probably is, a part of the expressiveness of the piece.

In short, the indication of the answers is that this Prelude expresses simply *recurrent activity without progress*, whether grave or gay, intense or mild, purposive or purposeless — all being indeterminate. The determinations of those points in the above formula as well as in the judgments obtained are, it is indicated, mythical creations, which in my mind have grown up around the piece in the course of long acquaintance with it, and which in the listeners' minds have been evoked by the first impact of the music.

But if recurrent activity without progress is all the expression, import, spiritual content of the piece, it is a question whether it should be said to have any expressiveness at all, for it may be claimed that this much is *in* the music itself. It *is* recurrently active, and at least in the fifth bar from the end (beyond which its figure may be said simply to die away) comes round again to exactly the texture of tone that constitutes its opening bar.

We may, indeed, compare our result and the comparative lack of imaginative content in the main impression received by K (idea of organism), with the remark of C, that the make of the music absorbed his attention, and surmise that polyphonic music may, perhaps, in reality be less expressive, more musically absorbing, than melody or harmony.

II.

Gurney's characterization of the melody from *La Favorita* involves the two elements of weakness and absence of rigidity (flaccidity). Any definite suggestion of weakness is hardly found in more than seven replies: so K (feeble nature); L (dependence); N, G (faint hearted love); O (discourage-

pressiveness of a given music to its possessor, is that of apperception, enjoyment of the auditory content presented. This may in part be an effect due to the attention, which, without interest in a music, would tend to desert the sound and reduce the amount of coincidence between the auditory impression and those of others toward that of any juxtaposed individuals. The impressions of those who do not enjoy a piece would, in so far as this is true, fall under the head above referred to, of inattentive states of mind, not to be called impressions. The effect may in part also be due to the fact that an enrichment of the mood of mind, a more prolific development of feeling and fancy takes place under the awakening and stimulating effect of auditory pleasure. If this is not to exhaust the matter, if apart from attention and excitement the enjoyment of a piece makes it more expressive to the listener, the fact is interesting and piques the curiosity. In regard to mental type. It is said, and doubtless with reason, that certain persons possess, and others lack, "a sense for the language of tone." A vague phrase like this being of no use whatever in any exacter inquiry, we are again obliged, in order to have something to test, to invent a definite meaning for it, as we did in the case of expressiveness itself. This will be the following: An auditor possesses a sense for the language of tone, or is specially sensitive to musical expressiveness when his impressions are a better indication of the probable expressiveness of a piece than are those of others. To express this more fully, the probable expressiveness of various pieces being determined by finding prevalent agreements about them, the examination of the degree of fullness and clearness with which a given burden is reflected in the impressions of a given listener, extended to various listeners and various expressive pieces, may reveal the fact that this degree tends to be markedly higher in the case of some than in the case of the rest; by which is meant that, comparing impressions from more and more pieces, the average of completeness and clearness with which their burdens appear in the impressions of certain listeners will eventually be found much higher than the same average in the case of the others. In default of any convincing evidence of the existence of such a class we can only make surmises as to the peculiarity of mental structure which may be its distinguishing mark. We shall, nevertheless, postulate some connection between this characteristic and powers of musical invention in so far as to assume that composers of rank possess it; that is, we shall assume that the type of mind which is capable of creating structures of tone which the world recognizes as beautiful, will also be specially sensitive to the expressiveness of such creations.

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(b) No one states as unequivocally as *I* the *intensity* of the energy involved, although the notes of *E*, *L*, *M*, *A*, *E*, *G* and *I* may be conceived to imply it.

It is especially noted as *mild* energy by *A*, *H* and *O*.

To F, D, K, H and L the images suggested can hardly be said to have involved activity at all.

(c) All of the twenty listeners to whom the piece unequivocally signified activity, regarded this as *repeated* (I take it waves were present to A's mind).

This idea of the aggregation of like elements is lacking in the impressions of the other five, F, H, H, L and K, the latter especially remarking that the structure of the piece is organic and not that of accretion.

(d) These twenty listeners gave eight judgments affirming the activity to be *purposive*: so E, J (argument); H (parting branches); O (fashioning); L (conquest of an opposition); M (struggles of life); D (successful energy); E (flight against wind).

In fourteen it is without purpose: so E, P (dance); A (tree-tops); B and I (chimes); P, C (brook); J, N, A, F, G, I, K (waves).

(e) Of the eight who find the suggested activities *purposive*, but two agree with me in thinking them attempts at a *single achievement*: so L (conquest of an opposition); and E (flight against wind).

They are two antagonistic efforts to E and J (argument); successive steps in a labor to O (fashioning); and D (successful energy); successive achievements to H (parting branches); successive struggles to M (career).

(f) The twenty listeners to whom the piece expresses activity give fifteen judgments, agreeing with me that the activity is *without progress*; or at least arrives nowhere: so A (swaying); B, I (chimes); E (argument indecisive and dropped); H (advance, but no arrival); J, N, F, G, I, K (waves); E, P (dance); E (flight against wind); P (brook).

They give nine judgments affirming progress: so E (torrent); L (opposition conquered); O (fashioning); A (haven); C (brook); D (successful energy); M, G, J (peace).

Besides the agreements thus far mentioned, there is in the notes another which deserves notice.

To several listeners the piece brings the suggestion of a church and its chimes or organ: so B, I (church and funeral); D (organ); I, P (opening of service); L (wedding; organ). This is doubtless due to the polyphonic character of this prelude (which two listeners thought was by Bach), organ compositions having commonly such structure. These ideas are accordingly special *associations*, and are to be thrown out in a quest after the real intrinsic import of the piece.

The various elements of my notion about this music have stood the test of comparison with those of others in the following way:

(a) Deep gloom. The opinions are about equally divided as to whether the piece is bright or dark in emotional tone. The indication accordingly is that, although in a minor key, it has no pronounced emotional tone. This is noticeable.

(b) Intense energy. The fact that some notes can be interpreted as suggestions of strong activity, while to others it is expressly stated as mild, and the rest seem to regard it as moderate, is an indication that the piece does not, in reality, express any particular degree of energy.

(c) Repetition. A large majority recognize this element. In regard to (d) purpose or no purpose, (f) progress or no progress, it can be made out that the negative alternative prevails in both cases. This indicates that the element of purpose [and hence (e) determination of achievement] probably is not, and that the element of absence of any progress probably is, a part of the expressiveness of the piece.

In short, the indication of the answers is that this Prelude expresses simply *recurrent activity without progress*, whether grave or gay, intense or mild, purposive or purposeless — all being indeterminate. The determinations of those points in the above formula as well as in the judgments obtained are, it is indicated, mythical creations, which in my mind have grown up around the piece in the course of long acquaintance with it, and which in the listeners' minds have been evoked by the first impact of the music.

But if recurrent activity without progress is all the expression, import, spiritual content of the piece, it is a question whether it should be said to have any expressiveness at all, for it may be claimed that this much is *in* the music itself. It *is* recurrently active, and at least in the fifth bar from the end (beyond which its figure may be said simply to die away) comes round again to exactly the texture of tone that constitutes its opening bar.

We may, indeed, compare our result and the comparative lack of imaginative content in the main impression received by K (idea of organism), with the remark of C, that the make of the music absorbed his attention, and surmise that polyphonic music may, perhaps, in reality be less expressive, more musically absorbing, than melody or harmony.

II.

Gurney's characterization of the melody from *La Favorita* involves the two elements of weakness and absence of rigidity (flaccidity). Any definite suggestion of weakness is hardly found in more than seven replies: so K (feeble nature); L (dependence); N, G (faint hearted love); O (discourage-

ment); P (gentle sadness); F (hesitation). The element of flaccidity may be thought, perhaps, to appear in eight cases: so E, P, G (plaintiveness); H? (melancholy); I (relaxed body); L (dependence); O (discouragement); K (sad meditation). The result may be said then to be the negation of Gurney's interpretation in both points.

In so far as a setting by Donizetti is not to be regarded as a somewhat hap-hazard selection from his note-book, we can take the operatic situation for which he wrote as an indication of his own conception of his work. The words of "O, mio Fernando" are an expression of passionate regret, a resolve of sacrifice, and a cry for death. The situation is La Favorita's choice to give up the man she adores and who adores her, rather than deceive him by hiding the dishonor of her past life. Here regret, complaint and resolution take the place of flaccid feebleness; but these characters fare hardly better among our listeners. For regret and complaint may be cited A (liebesweh); B, J (despair); E, G, P (plaintiveness); F, I, D (regret); H? (melancholy).

A hypothetical burden for the melody, which a general survey of the replies suggests, might be formulated as *yearning*, or want of attainment. For this interpretation may be cited A, B, C, E, F, I, K, L, N, O, P, A, D, E, F, G, J, L, eighteen voices. But as in the last selection, it is a question whether this can be considered as *expressed by*, or whether it is not rather *in* the music. I mean by this, as before, that taking the content of pure *sound perception* which makes up the melody, leaving out any emotion, and leaving out any fancy which is not an image of a *sound*, we find therein an end set and unattained. This end is the *tonic-note* of the melody, which we may conceive as floating in the fancy of its hearers as a wished-for sound. The song begins away from it (on the note called the mediant), wanders about in the scale (of E) without letting us rest in this desideratum of the ear, and ends (in the fragment played) on the note above the tonic, leaving our sound-wish unsatisfied. The general scheme of the experience we call yearning is thus given purely in the sounds of the song, and something more must be claimed (e. g., an emotion which goes with an end unattained) in order to give the melody any expressiveness at all.

The phrase in which Gurney characterizes the melody from Der Freischütz contains beside the element of beauty (fair) three others—serenity, permanence and strength. We can find an atmosphere of serenity in, at most, six answers: so C (satisfaction, assurance, relief); H (serious joy); O? (confidence); G? (cheerfulness); J (attainment); K (serene joy). Permanence appears, perhaps, in E (joyful looking to

the future); *L* (hope); *K* (serene joy); and in the second poem cited by *N*:

"But years must teem with change untried,"

"No fear! or if a fear be born
This minute, it dies out in scorn."

Neither of these characteristics is therefore to be admitted. Some suggestion of strength may be found in sixteen answers, viz.: *A*? *B*? (triumph); *H* (sunlight); *I* (up and doing); *K* (strong nature); *L*, *P* (vigorous); *M* (sparkling breeze); *C*, *N*, *O*, *L* (confidence); *C* (impetuosity); *F* (resolution); *H* (energy aroused); *I*? (lively). We may, perhaps, count this latter consensus as a corroboration of Gurney, and assume that the melody probably does express vigor.

Calling in now Weber as a witness, on whose high standard of fitness between poetry and music we may safely rely, this element of vigor is again indicated. At the opening of the air (which alone was played), Max sings—

"With a light heart I roamed through wood and field;
All I caught sight of fell before my trusty rifle."

Here we have the suggestion of vigor, high spirits and independence; or morning hours too, and the open air.

Sixteen of our replies recognize an element akin to light-heartedness in the melody: so *A* (light-hearted); *D* (gaiety); *E*, *F*, *G*, *H*, *K*, *L* (joy); *I*, *N*, *P* (buoyancy); *O* (gay, non-chalant purpose); *A* (allegro); *E* (shallow buoyancy); *G* (cheerful); *I* (lively). Even suggestions of independence (cf. *I*, *L*, *M*) and daylight and the open air (cf. *H*, *M*, *E*, *H*) are not wanting. We may fairly add the element of buoyancy to that of strength, and as the result of our test claim *light-hearted vigor* as the probable burden of the melody.

III.

The opening of the Sonata Pastorale conveyed to Gurney the idea of *resistless movement*, all the more resistless after the interim of runs. Out of twenty-four listeners who gained some definite suggestion from the selection fourteen connected it with a movement or progress of some sort: so *B* (half-sung soliloquy); *D* (orchestral climax); *E* (a coming good); *F* (advent of spring); *H* (mild progress); *I* (railway train); *N* (flight into the blue); *P* (abandon); *A* (learning to walk); *D* (consent); *E* (advance toward a decision); *G* (dance); *H* (an uplifting); *K* (a rocking boat). The effect of power on the other hand is felt by not more than eight: we may perhaps discern it in *C*, *J* (invigoration); *E* (stress of impatience); *I* (railway); *N* (religious context); *D* (consent of many); *H* (divine uplifting); *E* (conflict).

According to our listeners, then, the impression of resistlessness is not in the music as written. We can regard it perhaps as a special product of the piece in Gurney's mind. Indeed while feeling this impression unequivocally, Gurney distinctly recognizes (p. 172) the possibility that others may not. Or again, this may be a case where an impression is the growth of a particular habitude of the rendition of the music. There are traces in our replies of the conception of a surrender to some power: so *I* (to rhythm of rails); *K* (to the waves); *N* (abandonment of finitude); *P* (festive abandon); *B?* (serene confidence); *D* (surrender of many wills); *H* (sustaining power of faith). It is not impossible that were this conception in the mind of a performer, such impressions might become more frequent and be found to develop into the sense of compulsion of passionate movement that Gurney felt.

The number of persons who found a certain triviality in the music is worthy of note. Thus *B* (careless soliloquy); *D* (ephemeral feeling); *E*, *K* (pearl-color, powder, carved walking sticks); *G* (opera air); *I* (song chorus); *L* (trivialness); *M* (frivolous); *N* (jolly flight); *P* (gay responses); *A* (infancy); *E* (inconsequence); *G* (fête).

Perhaps after all a *happy surrender* is the most promising hypothetical burden to be derived from our replies: for surrender becomes triviality when the compelling power is slight and when it has grown great is the sign of its resistlessness.

IV.

Of the Chopin Ballade, Rubinstein writes: "Is it possible that the performer should not feel the necessity of representing to his hearers; a wild flower caught in a gust of wind, etc., etc.," intimating that this impression is to be given in the rendition. It has nowhere completely emerged in our replies, as a comparison will show. The conception may be formulated thus: *A* character of innocence and gentleness attracts the admiration of a bold wanderer whose, persuasion met by reluctance becomes violence that conquers by destroying. The story then opposes weakness and simplicity and fascination to strength and experience and desire; tells first of gentle means opposed inertly, then of harsh means opposed feebly; then of a victory that is death to the vanquished. The dramatis personæ are two, defenseless charm and imperious longing; the action is the attack and ruin of the former by the latter.

The closest approximation to this story among our replies is that of *E*; but here the actors are the worse and better elements of one nature. As in Rubinstein's interpretation

there are here two stages of the conflict, one in which the purer and weaker element still maintains itself, and a second and sterner struggle in which its downfall is complete. The last few bars where, perhaps, in Rubinstein's fancy, the fallen flower exhales its life, *E* has beautifully interpreted to mean the survival in outward conduct of the blamelessness the heart has lost. Next nearest perhaps is the impression of *K*, in which while all the movement in Rubinstein's impression has faded out, there remains his conception of two personalities, one who will not be gainsaid, however the other may expostulate and entreat. Two personalities, a stronger and a weaker, appear in *D*'s suggestion of George Sand and Chopin, but certainly no masterful beating down by one of the opposition of the other, no mortal victory. The introduction depicts to *C* a personality at peace, yet it is not the calm of untroubled innocence, but that of resolute renunciation; and it is this element which is the stronger in the conflict that follows, and upon which desire and entreaty exhaust themselves in vain. The framework of *B*'s story (murder) is curiously like that of *C*'s, although the background of mood in the two is so diverse. The *presto con fuoco* represents to both a superior power opposing itself to wild entreaty, and in both it is the victorious element (and not the vanquished as with Rubinstein) whose controlled strength is suggested in the prelude; only in *C*'s story it is the weaker and in *B*'s the stronger element that is the aggressor. Further *B* brings in a third element, the march of surrounding event, with which we may compare the solemn tendency caught sight of by *O*. On the other hand, in *N*'s story of the lover bereft as in Rubinstein's of the flower, the element portrayed in the quiet introduction is that which succumbs later to a resistless power. Yet it falls, not in a gradual contest with a personal force as Rubinstein has it, but to the instantaneous blow of some fate; (in the poem, death) and the struggle is an effort to *win back* what was lost. One of the pictures (a battlefield) suggested to *K* is very similar to this: for here, too, the quiet introduction depicts peace (to be sure, sorrowful or monotonous), and the tumult is its destruction in a sudden calamity, and possibly to efforts (search) after its restoration. Happiness wrecked by a sudden calamity appears again in Browning's poem "In a Gondola" suggested to *I*. With these the other story suggested to *K*, that of Dido and Æneas, has in common a shattered paradise of love, and (excepting *I*) unavailing efforts to regain it; here again it is the beloved who is bereft of her lover, yet the calamity is not external, but his own act. The trait of a struggle to regain something lost (*N*, *K*) reappears in *O*'s

impression, in which while the calm introduction portrays maidenly innocence and peace as it does to Rubinstein, the tumult is an effort to *rescue* the heroine after some external calamity and not the progress of her downfall. Love is the burden of the introduction to A, as to N, K and I, but the lovers are together in disaster and together lost; together in disaster, too, are L's friends, but it is inward dissension, not outward misfortune. The scene of Ophelia's burial and Hamlet's struggle with Laertes came to D's mind: not her tragedy that had then been played through, though this latter is much nearer Rubinstein's conception.

In several of the impressions only broad outlines of a drama of tumult following peace presented themselves: so F, D (passionate interlude in a quiet life); F, J (peace; conflict; rest); G, P, I (storm); I (a child's future peril dreamed by the mother); J (peace; catastrophe; ruin); K (sad monotony—disaster upon disaster; ruin); M (cloistered peace engulfed in disorder and surviving only in memory); B (struggle; success).

To some listeners only disconnected scenes were suggested: to C (devotional; storm; gaiety; stormy; gentle again); A, G (gaiety or peace; apprehension; grave joy; stormy passion; memory of gaiety, or peace again); P, H (cloistered peace and wordly tumult); L (storm and music).

Finally, in two stories cast in the same general mould, E and H give a faithful record of the surrender of the sense of musical charm to the sense of the ridiculous. The resistance of E to demoralizing laughter is no less edifying than the frankness with which he frees his mind about the selection. His hero's malformation and the dismemberment of H's heroines; fruit of the monotonous introductory rhythm and the riotous discord later—show clearly wherein the Ballade makes exactions upon the listener.

Summing up we find that the quiet introductory theme, identified by Rubinstein with a personal type of weakness, inexperience and charm, is in sixteen impressions interpreted as depicting a *condition of quiet*; so F, J, J (peace); K (sad monotony); P (a soul at peace); N, A, L, I (happy love); M, P, H (cloisterers); C, G, L (devotional); B (stealthy movement); and in but nine suggestive of character: so D (Chopin); F (youth); D, O (young girl); E (rich-minded sobriety); H (doll); I (infancy); C, E (sensitiveness and force).

While the presto con fuoco is generally recognized as a scene of storm or conflict, by eleven listeners the elements at war are not definitely distinguished: so C, G, L, A (storm); M, G, J (war); F, P, J (conflict); F (excitement). Of the

remaining seventeen listeners fifteen (all but L and D) recognize with Rubinstein a stronger and a weaker antagonist: so A (perils; lovers); B, I (murderer; victim); D (George Sand; Chopin); E (rapids; swimmer); H (boys; dolls); I (vicissitudes; individual life); K (Æneas; Dido; or a soldier's fate; his beloved); N (fate; a lover); O (misfortune; a victim); B (purpose; disappointments); C (resolution; entreaty); E (inclination; duty); H (the strong; the weak); K (desire; entreaty).

The stronger is a person as in Rubinstein's story in nine cases: so B, D, H, K, B, C, H, I, K; but his identification of the weaker with a character presented in the prelude occurs but three times: so D (Chopin); E (swimmer); I (infancy); identification with an element or elements presented in the prelude occurring five times: so E, A, H, K, N.

A definite ending to the struggle appears in twelve impressions: this is destruction in some form in seven: so A (wreck); B, J, I (violent death); K (despair); E (fall); O (sacrifice); a failure of destructive efforts in one C; a failure of constructive efforts in two N and K; and their success in two D (old life enriched) B (success).

The closing bars of the piece are interpreted in thirteen impressions as a return of some semblance only of what was pictured in the introduction: so A, I (subsiding sea); B (remorse); D (old life enriched); H (sole survivor); I (good-night); J (hush); M, N, O, A (happiness remembered); D (thought of the dead); E (outward purity).

It is evident that there can be found in these answers no prevalent agreement on any but a very meagre story. More can hardly be claimed as the conception of a majority than that of peace followed by a struggle of a stronger with a weaker element, which is renewed after an interval. All the rest of Rubinstein's interpretation the test has failed to confirm, thus corroborating the negative side of his opinion, viz., that this story is not contained in the music as written. Our replies possibly add as a hypothetical outcome of the drama the return of at most a semblance of a former peace.

But for the third time we meet the question whether, if this be all its burden, the music can be said to be expressive at all; for as much of a drama as this seems to be contained in the flow of sound itself that constitutes the piece; the formula simply enumerates certain characters taken on successively by the listener's auditory perceptions. The beginning of the piece is quietly monotonous as a sequence of sound. Later, there are in the auditory perceptions two elements, a stronger and a weaker, in conflict; the latter being the *image* of the diatonic scale in the mind of the hearer, which opposes the

introduction of notes foreign to it; the former being *sensations* of such notes (e. g., B sharp, the piece being written in the key of F) which enter nevertheless, and powerfully; sensation being stronger than fancy, we have an antagonist which conquers, and an antagonist which yields. Finally the sound of the closing bars *is* a semblance, and only a semblance, of the quiet flow of tone constituting the introduction. According to this the present test not only negatives Rubinstein's dramatic image, but offers no suggestion of another. The piece may be imaginatively expressive and what is thus expressed may be the story of the flower, but whatever it be our replies have failed to indicate it. We must have recourse again to emotional elements, forming a prevalent progression, of underlying shades of feeling in the various images. The formula might be: peace (several find it clouded in some way); fear. To several the close is regretful.

The two characteristics of suggestiveness and expressiveness in music are to be differentiated. A music is suggestive when the tones come embedded in a rich mood of fancy and emotion; it is expressive only when we find these moods alike in comparing one with another. Hence, it may be said that music is never so suggestive as it might be were it not so expressive. A lack of expressiveness may spring from two causes; a piece may be too little or it may be too diversely suggestive. The negative results of inquiry IV. are certainly due to no want of response to the Ballade in the hearts of this company of hearers.

V.

The Andante of Beethoven's opus, 109, depicts a mood that brought to the point one hardly cares fully to express even in the interest of truth. One wonders whether there is another art whose product could do quite the same. The replies unquestionably confirm my impression that the fragment has religious significance. There is more unanimity here than about any of the other selections. In describing the atmosphere of the music, words of religious import are used in nearly half the cases: so H, I, J, L, M, O, A, C, G, I (religious); F (prayer); H (aspiration); K (worship). More or less closely allied impressions are G (a placid mood in the presence of the sublime); C (resignation); D (peaceful sadness); E (grave, not regretful); P (tender seriousness); B (seriousness of life); E (comfort in sorrow). More divergent are N† (calm dignity); D (placid retrospect); F (retrospect); K (quiet happiness). Three listeners detect a certain unrestfulness in the music: so B (doubt); L (unrest); L (restlessness).

One listener (M) remarks on the likeness of the piece to German church music. Admitting this to be the source of its religious impressiveness, the agreement upon this would then be of associative origin born of the familiarity of the audience generally with this form of ecclesiastical composition, and not a real message carried beyond the limits of this acquaintance. It would be a difficult enough matter to find listeners who should not have such associations and who should at the same time be capable witnesses: but had this been the source of the unanimity in the present replies, one would have expected to find in them more ecclesiastical or ceremonial references than the three we have: viz., besides M, K (Strasburg Cathedral); N (ceremony).

VI.

The comic element which Engel finds in Barberina's aria in the *Nozze di Figaro* can be detected in the impressions of at most five out of twenty-two of our listeners who report on this selection: so C (sad humor); E? (uncouthness); N? (no high tragedy); H (teasing); L? (doll). This result (looking at numbers alone) negatives the idea that the trait in question appears in the music; and indicates as its origin the dramatic and poetic setting of the air, whose effect in the mind of one familiar with the opera is no longer to be surely distinguished from that of the texture of tone. But our conclusions must now, I think, be more than ever tentative, for the fatigue of the audience has by this time become a factor to be reckoned with. Further, we find that in one of the replies possibly to be adduced as evidence for an element of humor in the piece, the dramatic situation for which Mozart composed it is recorded almost as it might have been had the listener had the scene before him as he wrote. Barberina has lost the pin that the count gave her to carry to Susanna, and sings: "I have lost it; poor me; who knows where it may be? I can't find it; and my cousin; and the count, what will he say?" The impression he received from the music of this complaint N describes thus: "It is an impression of some one seeking in hope and sadness mingled for some lost thing; whether a lost child or a lost latch-key, I can't say." But it is evidently the latch-key, for there is "no high tragedy" in the music, and even so he has himself searched his pockets "for the last nickel and found it not." To N there was, in the music, not only a suggestion of search unsuccessful but of search with a certain element of triviality about it. But for the element of dismay in the words, one could hardly go further unless to designate the object as a pin, the loser as a serving maid, etc., etc., which details the

devoted believer in musical expressiveness could hardly demand.

This coincidence, which was due to no conscious recollection of the opera (heard, if ever, a dozen years ago, in Germany) on N's part, may be explained, if we please, as a feat of memory too recondite to give any recognizable account of itself. Or again, the particular nearness of the approach to Mozart's idea may be what we call a chance. The remaining alternative is to consider it a real striking of hands on the Elysian fields between Contemplation and Creation. There is a type of mind, according to this, Mozart and N being instances, to which music may have an expressive burden, as complicated, as the notion of an unsuccessful search after an unimportant thing. The premises by whose aid we draw this inference from the fact of this coincidence (we have had complex coincidences among our replies before) are two: the assumption (already made in Weber's case) that the aria of Barberina sprang into being out of a mood in Mozart's soul of vivid realization of the scene to be given a musical accompaniment; and the assumption that the mood of composition whose precipitate is a given music, is a better indication than that of any mere auditor of the retinue of spiritual elements with which the music will be apt to be accompanied. On these assumptions N is indicated as possibly one of the natures specially sensitive to musical expressiveness, of whose existence we have been prepared to find evidence.

But let us inquire what prevalent agreements exist among the other replies, and what, if anything, we can more plausibly add to them, by the aid of the principle just stated, as a part of the hypothetical expressiveness of Barberina's aria.

We shall, I think, in this way, reach an indicated burden which may be analyzed into the four elements of weakness, simplicity, desire and pain (meaning by pain simply disagreeableness, not physical pain only, nor only the intensely disagreeable). As to the origin of these various elements, the following hypotheses may be made: The weakness and simplicity are, perhaps, given in the want of intensity of the strains, their small range of movement in pitch and their small duration in time (iteration). The desire is given, perhaps, in part by the fact that the melody keeps away in great measure from that desideratum of the ear, its tonic note, beginning and ending on the dominant; and in part, perhaps, by some resemblance in its flow to the intonations of the voice in uttering a wish. The germ of the pain is already given in the desire, but there is unquestionably a likeness between the semi-tone changes which are prominent

in the melody (c', d' b; b' sharp, c'; e' sharp, f') and the continuous change of pitch through a small compass characteristic of the gentle expression of pain by the voice (moaning); further, the fact that the music is the minor mode is another source of pathos.

The wind about a house to which B likened the music changes its pitch continuously through a small interval, like a cry or moan of pain. B used the former word; the latter is chosen by P, in whose impression a human suggestion enters. In J's picture of the expression of a diminutive anguish to the vocal utterance of pain, add themselves the ideas of weakness, simplicity and indefinite desire (crying child). Here L takes up the suggestion and constructs on it a little nursery story of a child's plea with her doll for affection. In the impressions of F and I, which also contain the idea of entreaty, this suggestion of simplicity and want of development falls out and the main image is one of desire and pathos (pleading for forgiveness). But developed into rusticity and uncouthness it, in its turn, is the principal part of the image of E, where the idea of entreaty is only to be inferred from an unwillingness and final consent that was heard in the music. A picture not unlike is that of H, where a certain simplicity, with a dash of irritation in it, appears in the notion of teasing, entreaties becoming simply questions. Questioning is the sole content of H's impression and D's, and in the form of uncertainty enters into those of C and G. The latter, further, expressly mention *search*, the only one of the listeners, beside N, to do so. Pathos and weakness, with or without desire, enter into the impressions of A, M, B and J. In those of K and E the simple monotony of the music, with its touch of mild sadness, have become a resignation to the humdrum; A makes it even a sunny resignation, C a humorous sadness. In the reply of N finally the elements of simplicity and mildness manifest themselves through his tendency to suspect the woe, is a light affair, those of desire and pain in the search with grief.

Taking all the twenty-two replies together we find a marked prevalent agreement on the elements of pain and desire; fifteen or sixteen voices for each. Further, introducing the evidence of the dramatic situation, that is, taking Mozart as a hearer, whose opinion counts for more than that of any other, weakness and simplicity, since they form a part of Barberina's character and are each recognized by a sizable minority of our audience, become further hypothetical elements of the burden of the piece. Whether we should admit the element of search (active desire for something lost) supported by the agreement of the dramatic situation with but two of our

replies, is a question to be best settled by a new test of the melody with other listeners. But there remains a presumption that N belongs to a type of mind specially sensitive to musical expressiveness, for besides this doubtful element, his reply contains all those we have found reason to conclude, enter into the burden of the selection. This is true of but two others, those of J and L. The fact finally that one of these (L) may possibly, like N, be conceived to have felt, in the melody, something of the playful atmosphere under whose influence Mozart undoubtedly wrote, leaves us in doubt as to whether Engel may not be right, after all, in claiming that Barberina's song has comic traits. This is another point that only further experiment could settle.

Of these four elements the pain is certainly emotional; there is an emotional element likewise in the spiritual state we call desire. These two the music must be admitted to have as true burdens; they are not contained in the auditory perceptions. But the non-emotional side of desire appears to be a character of the music itself; and the melody certainly is a mild and simple structure of tone, although it may *express* these traits too.

VII.

The opinion of Gurney quoted above about the fragment from Händel is to the effect that an absolute dejection is already expressed in its first five bars, this character being mainly the contribution of the phrases we have called *b*, *c*, and *e*, *f*. These carry a suggestion of human movements of drooping and sinking, which is emphasized by the pause between them, as if one resisted momentarily only to give way more completely. This impression of pathos is recognizably deepened at the note *g* flat in the sixth bar.

Assuming that the melancholy character of this fragment would be generally felt, the question remains whether Gurney was right in regarding the descending thirds and the *g* flat as the main factors in this result, and right in surmising that the thirds act through suggestions of human movement. This is no longer the inquiry simply into the spiritual state accompanying music, on which we have hitherto been engaged. What we want to know now is, with what elements of a certain complex of tone the impression of sadness it makes (if it make one) is mainly connected, and what is the link between them. Not only susceptibility to impressions from music is here demanded and powers of introspection and expression capable of catching sight of and hitting them off in words, but powers of analysis able to trace an element of spiritual state to its source, in an element of auditory per-

ception, and of noting what it is in one that brings up the other.

In spite of the difficulty of this task, something of a consensus emerges from the replies and one that favors Gurney's analysis. To fourteen out of twenty-two listeners the phrase we have called *h* and which contains the *g* flat remarked upon by him, is one of the parts of the air most expressive of melancholy; and seven of these (viz.: O, E, I, C, L, H, J) find therein the culmination of this effect, three (A, B, F) finding it in *h* and *i* together. According to C the extreme dejection begins upon the *g* flat, and I calls it the decisive note of the piece; with the other flatted notes (*c* and *d*) its part in the impression of sadness is also remarked upon by K and M; the flatted *c* being specially singled out by J. About the rest of the fragment there is not so much agreement, but what there is points out *i* and the two passages of descending thirds as main agencies in the effect of melancholy; nearly half the listeners selecting these phrases. A few chose the others (*a*, *d*, *g*) and some regard the impression as a resultant of the whole texture.

That the burden of the piece might be thought either sadness or dejection was suggested in the question, and the opinions of the audience seem to be nearly equally divided as to whether or no it expresses hopelessness as well as melancholy. Beside the word dejection, hopelessness is used (L, E), discouragement also D, and abandonment (H). On the other hand, sadness alone appears to have been recognized by D, E, J, G, M, A, B, F, K, and a positive opinion against hopelessness is expressed by A, B, N and O. Nothing more than that the melody is deeply sad can be considered as distinctly indicated by the tests, and if, in this doubt, we appeal to the words for which it was written (assuming this, though Händel often adapted to new words his own and others' music), the element of dejection is negated, for it is grief and pity only that are their burden.

As to how it is that the phrases selected come to have their sad expressiveness, some interesting judgments are given: (by E, F, J, K, M, N and E). The principal consensus to be detected among them is the recognition by J, M (sighing) and E (hopeless suggestion) of a likeness to the intonations of the voice in the expression of sorrow, exhibited by the progressions of thirds (*b*, *c*, *e*, *f*), which suggested bodily movements to Gurney; F also remarks upon this likeness, but asks whether it may not mainly be due to the portamento of the violin (wailing). The image of speech interrupted by expressions of grief seems to be prominent throughout both to M and to E, the sad expressiveness of

phrase *i* being concerned, perhaps, to the former with downward vocal movement. While the same phrase suggests giving way to *E* and to *J*, this is undetermined as either vocal or muscular. To *I* and *N*, on the other hand, phrase *i* carries a certain consolation with it. *N*'s picture and that of *K* are drawn throughout in lighter colors than those of *M* and *E*; *M* finds only sad words and *E* bitter conclusions in the sounds that to *N* have consolation, and to *K* grandeur in them. In the latter image the melody is no longer a voice, but a life, and the interruptions of the accompaniment not sighs, but the fates that come between it and its aims. But although *K* seems to have had no suggestion of sinking voice or drooping limbs, he mentions other elements of melancholy in the air besides its suggestion of thwarted human plans. Like *M* he remarks upon the introduction of three flatted notes, *d*, *e* and *g*. The first (occurring in *e*) acts through changing the key of the melody from *eb* to *ab*. Why this change should have pathos does not at once appear. Certainly, on the face of it there is no necessary suggestion here of downward movement; we cannot say that *ab* is lower, or higher than *eb*; it depends on what *ab* and *eb* we choose. There is, perhaps, a more recondite factor here at work, that of the interdependence of the keys of the modern European musical system. According to the theory of Hauptmann of keys a fifth apart, as those of *eb* and *ab* may be conceived to be, the lower is a relaxed form of the higher; a key *strives* into that of its upper fifth and *sinks* into that of its lower fifth. Into this point we cannot go further. The second two flatted notes, *g* and *c*, change the *mode* of the melody to minor; and this may be admitted as a sufficient reason for an effect of sadness, although why it should be so is, as above noted, not yet distinctly made out. We can add a third way in which all three of these flatted notes may have aided in the effect of this music; through their suggestion, that is, of a failure to attain an aimed-at height. For all these notes are slightly lower (by a semi-tone) than others which still linger in our minds from the earlier parts of the fragment (*d*, *g* and *c* natural), and the striking of this slightly lower point of pitch the mind may interpret as failure, or as a sign of diminishing strength.

Summing up, the test indicates that the burden of the fragment is perhaps deep sadness rather than dejection. As to the principal factors in the effect Gurney's opinion is confirmed, viz., descending thirds: *gb* in *h* (our replies mention also the other flatted notes); but the former seem to have acted upon our listeners rather through vocal suggestions than through images of bodily movement.

VIII.

The Bach Prelude, in which Rubinstein finds so remarkable a tragic expressiveness, suggested this word to one and only one (C) of our listeners. Two (I and O) acknowledged it in indirect tragic import by calling it funereal. While this result certainly bears against Rubinstein's interpretation, it suggests searching among the other replies for some general content of which the tragic may be conceived to be a special form. We shall, I think, find in them a hint of such a content; but an outline of import which a look at the musical make of the Prelude will once more convince us is nothing extraneous to the composition, but simply the combination of two characteristics of the mass of auditory perception of which it consists. Certain of the replies indicate, moreover, another than a tragic picture of which these characters form the outlines also.

The only consensus which is at all striking among the replies is the agreement of a few listeners upon what may be called a certain fragile inconsequence about the music. L uses the word incompleteness, and further hits upon the technical character of the piece in calling it an introduction; it is simply unsatisfying to B; to J unstable; to M disjointed; to K perhaps this, but better whimsical, and this latter judgment is repeated in the impression of D, where the element of want of connection appears in the idea of improvisation (playing and dreaming) and that of incongruity in the adjective fanciful.

Looking in the music to see whence this impression originates, we find (and this we shall have to content ourselves with simply claiming) that the quick moving melodic element of the texture awakens naturally in the ear of the listener anticipations of its further course that in the event fail of realization. We find, in other words, that inconsequence is a characteristic of a certain factor in the music; this factor is, moreover, a *light* complex of sensation, by which is meant only that it lacks intensity and volume.

But contrasted with this melodic inconsistency and incompleteness we find in the piece massive harmonic complexes (chords) in regular and often undisturbed recurrence. And looking back among the replies we find several which may be interpreted as recognitions of this element in the texture. C finds the music heavily monotonous; to A it is at least satisfactory; B finds it soothing, and to K it expresses contentment.

In the reply of E, finally both elements are recognized, heavy uniformity and delicate waywardness. E is the only

auditor familiar with the piece, and gives in her reply what we may claim as another confirmation (besides that of C in I. and I in VI.) of the remark in the invitation to the experiment that "an interest in the purely musical aspect of a composition might hinder rather than help" its imaginative interpretation. For usually so full of fancies drawn from life, *E* records here only a structural image taken from (what is called) the nearest art. The "delicate tracery of the frescoping and pillar ornamentation" in this reply suggests Hanslick's phrase, "the many daintily elaborated salt-cellars and silver candlesticks of the revered Sebastian Bach." Yet *E* recognizes first in the music "the massiveness of a cathedral."

The replies that remain record principally emotional as distinguished from intellectual impressions from the piece. It is gloomy to *F*; to *H* expresses sadness, and to *J* languor and reluctance; while dignified, it is non-emotional to *G*; it is sad although elevated to *L*; *A* finds it religious; to *H* it is philosophically elevated and to a dizzy height; while *N* hears in it "a seraph's song, a song as of one excelling in knowledge."

The grave character that all these listeners recognize in the piece is certainly in part the shadow cast by its minor mode, according to the mysterious habitude of this musical form. But most find also an elevation in the music, and this agreement points, I think, to another imaginative picture besides that of the tragic which can be drawn within the outlines laid down by Bach in the texture of sound he created. Which of these can be called the burden of the piece? If either can be our evidence is insufficient to decide.

We have found in the music two strongly contrasted elements: massive complexes of tone in continual recurrence, and a light current of melody having a certain character of inconsequence. It is easy for the fancy to weave between these two presentations of the sense a relation of cause and effect; to make the light inconsequence the result of the heavy insistence, and to picture further the strong monotonous chords as some unswerving natural force or some changeless divinity, and the wavering and often tremulous melody as some personality powerless in comparison. If now the music be approached in a troubled temper and its gravity be heard as gloom or sorrow, there is no thought more natural than that of the wreck of human plans by some over-ruling power. This is the conception of the tragic: the frustration of human desire by some remorseless fate or by the immutable decrees of some divinity; and its mood of feeling is that into which the melancholy of the music transmutes itself at these thoughts—awe before one and compassion for the

other—the fear and the pity of tragedy that Aristotle tells us purify the soul. But if these same melodies and harmonies be heard in a serene or buoyant mood, though the same picture be before us of created weakness in the hands of sovereign power, we see no more a life whose ruin tells of the terrors of divinity, we hear a trembling voice dying into silence before its glory; there is that within us that cast out fear, yet awe remains, and aspiration toward that seraph state.

IX.

In the Don Giovanni serenade the voice melody and that of the mandolin very naturally suggest two contrasted forms of personal mood. The mandolin music brings to the mind a mood of activity of a petty emotional content, the music of the voice a mood of passion (desire) of considerable emotional content. These are mutually exclusive conditions of the soul, and combined in one nature either must be assigned to different strata of it or must be conceived to dispute with one another its possession. That is, a nature cannot at one and the same time be in a predominantly active temper of trifling emotional excitement, and in a predominantly passive frame of fervid feeling. These must alternately occupy the spirit, in which case one may be more frequent or longer sustained or nearer to the personality in being concerned with ranges of idea more intimate in its life, or again there may be nothing to choose between them in these respects. The former supposition may be symbolized as superficial and deeper strata of a nature; in the latter case the personality becomes to this extent what we call a contradictory one.

It seems to me that this serenade makes plain to the attentive beholder what the character of a Don Juan really is: a nature of which levity is the controlling note, notwithstanding numberless fits of amorous gravity. His passion is then superficial, there is a hollowness, a deceit about it. It lies very near to ascribe its expression at all to a *wish* to deceive, to find in the levity a mockery; at least when guided by the operative situation, one's imagination easily takes this step.

But certainly on the evidence of our replies, the Don Juan character cannot be claimed as the burden of this piece, considered simply as a structure of tone. The effects of *song*, it is to be remembered, are no longer those of sound alone. A song must have words and there must be some one to sing them, and these additions, of course, present us with a more or less definitely outlined character ready made. Such effects do not come within the scope of our inquiry, which is concerned with the expressiveness of structure of tone alone. It

is true that when asked for contrasted personal traits, which these two melodies suggest, our auditors agreed upon a certain earnestness in the voice part and a certain gaiety or indifference, or both, in the mandolin accompaniment. But some picture a character in which the earnestness is fundamental and the gaiety superficial; with some the gaiety is the undercurrent, and the seriousness the outward appearance; and with others they are simply contrasted moods. And whatever our conception of a Don Juan nature, it can hardly be that the picture is indefinite on a point as fundamental as this. Indeed, it may be said that there is no more agreement among these replies than was put into them in advance by the question asked, plus their recognition of the main contrast of emotional character between the sound complexes in question.

The lighter elemental is fundamental (as we have supposed it in Don Juan) in but five replies at most: so J (earnest character, with undercurrent of joyousness); L (merry temperament with serious intent); D (childish interest in a fiction); and especially in the replies of F and A, the only listeners to whom the music expressed the personal type we have assumed. F finds it only in the accompaniment, which depicts "a rollicking roué," and recognizes "more depth of character" in the air; A, who, though familiar with, did not recall the song at the time, detects in it exactly the Don Juan attributes of "levity and amorous sentiment."

Four of the replies do not specify either element as predominant; but describe contradictory or at least mixed moods: so H (passionate plea in a laughing accompaniment); I? (mountaineer); K (Marie Bashkirtseff); F (womanly contradictions).

In the remaining seven the earnestness is made the underlying element, and frivolity the superficial one: so B (higher purpose triumphing over the lower); K (David Rizzio); M (worldliness with undercurrent of sincerity); C (frivolity concealing real earnestness); G (womanly seriousness beneath a gay exterior); E (frivolity with steady strain of seriousness); K (playfulness feigned to conceal a sad heart). These last two replies, since the piece was known to the listeners, seem to involve an opposite conception of the Don Juan character to that here assumed. The reply of O (feeling in air; villainy in accompaniment) can be quoted in favor of our own; but certainly neither one nor the other is in any way indicated as the burden of this music.

A sufficient reason for this difference of opinion is, it seems to me, to be found in the nearly equal musical importance of the two contrasted melodies of the Serenade. Even were one

given with the fullness of voice tones, and the other in the gossamer of the mandolin, we could as well imagine either that the singer was speaking his heart while his hands were weaving a deception, or that his members were really at war with one another, as that his hands were revealing what his tongue was trying to hide. Certainly, if this is so, any special Don Juan significance vanishes out of the music; it is Marie Bashkirtseff as well, half given to the world and half to art; or it is the unfortunate Rizzio and the echo of the minstrelsy that covered up his sighs. Indeed, taken out of its dramatic setting why might not this music tell us of some wayward girl that cannot listen to an amorous plea for laughing; or depict to us some other comedy of two characters?

X.

In order to get a new form of question, the test of the character of the Russian melody, "*Der rothe Sarafan*," which to me expresses a certain deeply sad resignation, was attempted indirectly by asking a judgment on the possible origin of the song. Of twenty-one listeners, by whom it was not recognized, three attributed it with more or less certainty to northern races, one, *K*, agreeing with me that it betrays its Russian origin through its "undercurrent of sadness," another, *C*, finding a "pathetic wildness" in it that recalls the Russian or Norwegian people, the third (*L*) giving no reason for his surmise "Slavonic." The first judgment of *I* (old English) was based on a resemblance in style to certain English ballad-music, but this listener writes me, since, that the thought also presented itself "How sad! were these people so oppressed that this was their secret life?" To this testimony may be added the note of *H*, that the melancholy of the song is characteristic; but, on the other hand, another listener (*C*) to whom the selection was also known, found no trace of the Russian character in it. On the whole there is no case to be made out for my view; especially since a larger consensus ascribes a German origin to the piece (so *H*, *J*, *K*, *L* ? *M*, *N*, *A*, *E*, *F*, *J*); the spirit of sadness we associate with the Russian character certainly not being a Teutonic trait. Moreover, this Teutonic flavor is expressed as a certain simplicity only (*H* sentimentality). The impression on which the question was based is so strong that these negative results are interesting. It remains possible that earlier in the evening something more positive might have been the outcome of the test.

XI.

After the gay song in which the cards have foretold all manner of good fortune to Frasquita and Mercedes, Carmen deals them for herself: "Diamonds, Spades; Death? Do not lie! First I, then he; to both of us death!" The song "In van per evitar" then follows: "In vain to avoid their hard replies we shuffle them anew; it avails us nothing, the cards are sincere, they cannot cheat. If in the book on high the page is joyful, shuffle and deal them without fear; the cards will turn gladly in thy hands to announce thee pleasure. But if thou must die, if the terrible word is already written in heaven, the cards, to whose will thou needs must bend, will repeat: the tomb! Again; again; again; the tomb!"

According to the testimony of these words the song "In van per evitar" was the expression to Bizet of a mood in which there is felt: a capital desire (for life itself); a conviction of the absolute incompatibility of this desire with the decree of fate; and a feeling of submission to this decree. Trying to hear what the tones themselves say, nearly the same message comes to my mind; I find in them: a passionate desire for life; the certainty that death draws near; a complete resignation; the same elements without the conception of fate.

In estimating the amount of confirmation given this conception of the music by our replies, it is to be remembered that they were called out by what is distinctly a leading question. This determined that, in the minds of the listeners, the piece should be the vocal utterance of some special passionate situation. An outline picture was put before them—a human being speaking under stress of emotion—which, under the guidance of the music, they were asked to fill up as they would. It would only be by inference from our results that the independent expressiveness of this music could be reached; as they stand they indicate what it may be expected to accomplish, if certain outside aid be given.

The operatic situation is in its main outlines reflected in decided prevalent agreements among the replies. Seventeen out of twenty-four listeners agree that the singer is a woman; and eighteen agree that there is before her mind a picture of personal good fortune, and of some obstacle to its realization. But in Carmen's case this issue of personal fortune is (a) capital; the obstacle to the favorable alternative is (b) unconditional, consists, moreover, of (c) a decree of fate and calls forth (d) a feeling of submission. That the issue with which the song has to do is of capital importance to the singer is indicated, or can be inferred, in twelve of the replies: so *H*

(death); A, M, L (death of loved one); N (surrender of loved one); O, B (despair); G (bewailing past joys); C? D, K (unrequited love); J (passionate entreaty); to which may be added J (intense protestation); L (deep passion). The test then indicates that, conceived as a song, this music expresses a situation of supreme moment to the singer. One of the listeners (H) has even detected in it the ring of the death-song that Bizet had in mind to write.

The obstacle to the singer's happiness is represented or can be inferred as unconditional in ten of the replies: so A, M, L, H, D, F, G, N, B, O. It is not a lament but a plea to four listeners, E, G, C, A; the point being left undetermined by the remainder. We may take the agreement of this large minority upon an element contained in the words of the song to indicate hopelessness as, at least, a hypothetical element of its expressiveness. Possibly a similar remark is in place with regard to the element of submissiveness, which, however, can hardly be even read into more than seven replies: so A, D, E, N, O, A? L.

There is no agreement in regard to the character of the obstacle to the singer's happiness; it is death, the flight of time, an unloving heart, the demands of cause; but in no case fate. This alternative has indeed occurred to N, but to be expressly set aside. Since Carmen's trait of fatalism has its most conspicuous expression in this melancholy acknowledgment of the folly of a struggle against destiny, the discrepancy, in this point, between N's impression and what we must suppose to have been Bizet's mood, is interesting in view of his former coincidence with Mozart.

On the whole, our replies indicate the song to be a supreme lament, possibly hopeless and possibly submissive, at any rate with a certain calm about it. What is lamented or why it should be is not expressed.

Several replies include the whole of this content: so O (sublime, calm, despair); N, H, M, L, D and A (who adds another element); perhaps the reply of E should be counted among them.

Looking back over all our results we find the following mental content indicated as the probable or hypothetical burden of these eleven selections:

		<i>Imagery.</i>	<i>Emotion.</i>
I	Beethoven Prelude,	0	0
II	"O mio Fernando,"	0	Yearning.
	"Durch die Wälder,"	Vigor and light-heartedness.	

III	Sonata Pastorale,	Surrender.	Happiness.
IV	Ballade No. 2,	0	Peace succeeded by fear.
V	Beethoven Andante,		Religious sentiment.
VI	Barberina Aria,	Weakness and simplicity.	Pain and Desire.
VII	Händel Aria,	?	Sadness.
VIII	Bach Prelude,	0	Grave emotion.
IX	Don Giovanni Serenade,	?	Contrast of active and passive moods.
X	Rothe Sarafan,	?	?
XI	"In van per evltar,"	If a song: a woman's supreme, calm lament.	

While any assured opinion on so large a subject as that of musical expressiveness would be entirely out of place as the result of a single experimental test, any evidence, however meagre, gives some indication in regard to the subject to which it pertains. This indication, in the present case, may be admitted to go counter to widely held beliefs in regard to the extent of musical expressiveness. Our results point toward this conclusion in two ways. Although this programme is made up of specially expressive music, the amount of significance, imaginative or emotional, which can be made out from our replies is, it must be confessed, comparatively scanty. Further, they show us two ways in which listeners to music may easily be misled in regard to the amount of import in the tones they hear. In the first place, what is in fact a character of the given structure of tone may be mistaken for something external to it. Only the latter is what the music *means*, the former is what it *is*. The intensity or mildness, for instance, of a given note is not an element of its import or expressiveness; it is an attribute or quality of the sound. On the other hand, the height or lowness of a tone, using these words in their primitive sense, is not a character of a note, but an element of its import. A tone has no special place, whether high or low; but the extremes of pitch may be, and have been, combined with the determinations of place we call height and depth, and these imaginative elements then become elements of their expressiveness.

In the second place, what is in fact only a suggestion of a given structure of tone is mistaken for an element of significance in it. Because a music wakes a wealth of fancy and emotion in one's own spirit, one is apt to conclude that it must in the souls of others and in the same way. Our replies offer a good illustration of the untrustworthiness of this conclusion.

It may be worth while to call attention here to the fact that the present inquiry is a purely psychological one. The proximate aim of our experiment has been to find out what

it is that certain selections of music express. Its ultimate aim has been as stated in the invitation, to throw light on the question of the expressiveness of music in general. There is another question somewhat closely related to this and which is not always clearly distinguished from it. It may be formulated : does the *value* of music lie in the auditory impressions of which it consists, or in the movements of the spirit which accompany them ? This is not a psychological question as to what the effects of music *are*, but an æsthetic question as to what they *ought to be*. Two different conceptions of the art are here set over against one another. According to one, music is an art of *emotion* (and fancy) in which tone is used as the means of excitement, only because it happens to be through the ear that the soul can be most deeply, powerfully, and variously stirred. According to the other it is an art of *tone*, an incorporation of beauty in combinations of notes, of which emotion and fancy happen to be the ordinary by-product, just as smoke is of fire. No settlement of fact determines a question of beauty any more than it does a question of right. A psychological investigation like that here entered upon, being an investigation of fact, no conclusions reached in it would be any contribution whatever toward the decision of this vexed point in æsthetics. They have a bearing upon it, nevertheless, in this way : in so far as they indicate that musical expressiveness has been overestimated, they indicate, too, that on the emotional theory of its nature the importance of the art has been overestimated also.

In regard to the method of an inquiry into musical expressiveness. That of the present test was devised in advance of any certain knowledge that such a comparative method was possible at all ; in the event of further like experiment, two changes in it might be made.

One would be to do away with questions entirely, the music being left to make its own unaided impression. There were two motives which led to a relaxation in the present case from this norm of scientific directness. One was the feeling that without musical conundrums, as it were, to guess, the monotony of the evening would be intolerable and cause so much wandering of attention as to defeat our object. The other was the uncertainty as to whether, without external aids, music would have any expressiveness at all that was not too recondite to be put into words. Amid these doubts it was sought to hold a middle course between too much and too little verbal suggestion. But it seems now possible to say that with auditors skilful enough in the analysis of their own states of mind, and with both power and will to exactly report them, such an experiment, if not protracted too long,

needs no other foundation than the music itself. Our own made much too great a demand upon the mental and physical powers of the audience ; a shorter programme is, therefore, to be recommended.

A second change of method is suggested by the fact that even among auditors of an approximately equal knowledge of music, and skill and interest in it, we seem to find differences in capacity to detect its expressiveness. It becomes of special interest to compare the impressions of those whose endowments in this direction are greatest. To this end, a preliminary test might be made in order to select an audience for the experiment itself. It is true our replies indicate that it may not always be easy to decide who these specially sensitive listeners are ; but doubtless the testimony of the auditors themselves, as to the clearness and certainty of their impressions, may be something of a guide.

The present undertaking may be criticised in a variety of ways. It might, in advance, have been thought hopeless to expect to obtain by this method any semblance of the impressions that, under other circumstances, the same pieces might make upon the same listeners. But that the impressions here recorded are inadequate ones can hardly be claimed, now that we see with what detail they often reflect the musical make of the pieces to which they refer. Neither the presence of others, nor the obligation to have impressions, had the untoward effect on the susceptibilities of the listeners that we all feared. But it is possible that to some the whole inquiry may seem a search for something that does not exist. There are no prevalent agreements of spiritual state, it may be thought, among hearers of music ; the expressiveness of structures of tone is an illusion. This assertion is, however, either a surmise or a prejudgment ; and neither are valid against an attempt to bring evidence to bear upon a question. Or the assertion may be that the inquiry is at least off the track ; the expressiveness of music being something other than our conception of prevalent agreements among its hearers. It is to be hoped that any who hold this opinion will advance the discussion of the subject by the presentation of some other theory of the meaning of the phrase. Or waiving this question, it may be contended that what music expresses is literally *unutterable*. We cannot learn from one another what it is ; we must feel it for ourselves. Any attempt to discover it by a method of comparison, since we must proceed by a comparison of utterances, is foredoomed to failure. No interpretation, then, of music that was ever put into words but has entirely missed the true message of the piece—Beethoven's "Fate knocking at the door," Rubinstein's "Wind sweeping

over the churchyard," and all the rest. Although the world would be relieved of much nonsense, were this opinion general, in this extreme form it can hardly have many adherents. At least all that is most valuable, it may more plausibly be claimed, in musical expressiveness, is unutterable. Were our listeners never so sharp-sighted and never so deft with speech, all the best part of their impressions would be left behind in their hearts after the words had gone out of their mouths. Perhaps this is true. It is no news that there are realms of being beyond the reach of scientific inquiry; and among them may lie all that is best in the message of music. Our inquiry then can have but humble results; yet, how humble they must be we can never find out till we try.

Another criticism is unanswerable. It may be said that the opinions of these listeners are but a trifling contribution to a subject of immense extent, and that our conclusions are, accordingly, of the most problematical character. This they and I will at once admit. In itself the evidence we present is a small matter indeed; it becomes considerable only by comparison with that which has gone before of the same kind; for even a very small quantity is indefinitely greater than zero.

PSYCHOLOGICAL LITERATURE.

PSYCHIATRY.

WILLIAM NOYES, M. D.,

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ROUILLARD, *Deux cas de scarlatine compliquée de troubles mentaux*, Annales médico-psychologiques, 1891 XLIV. 262.

The author calls attention to the fact that while nervous and mental troubles are very frequent after small pox, less frequent after measles, they are very much less found after scarlatina. He does not affirm that scarlatina does not often attack the nervous system, for the relative frequency of the ataxic and ataxo-adynamic forms in scarlatina are shown by clinical experience. The connection of scarlatina with rheumatism is well known, as is also the fact that rheumatism plays a considerable rôle in nervous and mental diseases.

The interesting point to note is the late appearance of these troubles, after the eruption, during the convalescence, and even some time after the patient appears to have recovered,—a proof that the elimination of the scarlatinous poison takes place over a long time.

There are but few published cases in spite of the frequency of scarlatina.

Sée and Roger have shown the frequency of chorea after scarlatina. Genau, that of facial neuralgias, Sanné has observed a special rachialgia. Kennedy, in England, and Revillout, in France, have observed different paralyses, hemiplegias, paraplegias and monoplegias, generally curable and transitory. Weissenberg has published an observation on spinal meningitis in the course of the eruption, causing death in three days.

Mental troubles appear to have been observed more rarely. Shepard has published a case of paraplegia with transitory aphasia. In 1885 Abdy published one with partial hemiplegia and amnesia. Rouillard himself has reviewed the published cases of troubles of memory consecutive to scarlatina.

Rouillard adds to literature two cases of psychoses following scarlatina.

The cases presented no morbid heredity.

Case I. was that of a soldier aged 22. He had had three attacks of articular rheumatism.

During his scarlatina he had abundant albuminuria, with marked cerebral symptoms. After two months in the hospital he was sent home for convalescence, still very weak, but without fever. Three days after his arrival, without apparent cause, he had an attack of religious delirium, saying that he was no Christian, that he was a Jew, etc. That evening he had an attack of acute mania, uttering harsh and inarticulate cries, and seeing everywhere people who wished to kill him. The attack was so violent that he was covered with perspiration. A

viscid and sticky liquid came from his mouth. There was a second attack the next morning, with a high fever. At five o'clock that evening a third attack, with hallucinations, but the cries were less strong and the movements less violent. A period of depression succeeded this maniacal excitement, a melancholia characterized by an almost absolute mutism. To all questions the patient replied by shaking his head. In the course of this period the face was congested, the pupils moderately dilated, the respiration slow. The sensibility was preserved, but the perception suffered a marked retardation for the lower limbs. Constipation was obstinate. In spite of the apparent mental depression the strength was as well preserved in the lower as in the upper limbs.

If a limb was lifted the patient voluntarily kept it suspended until it was replaced in a condition of repose. During this whole period, from May to November, the patient presented no sign of any rheumatic pain. During August he slowly improved, and although he persisted in his mutism, yet his depression was not so profound. In reply to questions he would answer by signs with his head, and he appeared to wish to speak. The scarlatina had begun Feb. 24; on Nov. 2 his father announced that his son had recovered, and Rouillard was able to verify this. Patient replied intelligently to questions and had a perfect recollection of all that had happened. He had known what was asked him, but could not explain his inability to speak.

The second case was also a soldier, with no other heredity than rheumatism in the father. He had entered the hospital for pneumonia. On the sixteenth day, while convalescing from the pneumonia, an attack of scarlatina came on. This assumed a grave character from the beginning, and was complicated in a few days by a pleurisy. The urine contained a marked amount of albumen, and the patient fell into a state of stupor and enfeeblement with subnormal temperature.

Two months after admission he was sent off for two months of convalescence. At the end of the first month he had an attack of epilepsy. On his return to his troop two months later he had another, and this was followed by others.

In the discussion Auguste Voisin recalled two cases of acute mania in two girls in the first period of scarlatina.

Charpentier considered that Rouillard had not proved the existence of scarlatina, referring to the fact that among the insane there may be erythemata simulating scarlatina.

Gilbert Ballet also took exception to the conclusions of Rouillard, who seemed to consider that he had described a special form of epilepsy and insanity—a scarlatinous epilepsy and insanity. With regard to the first case he would not agree with Rouillard. He would be inclined to think that the epileptiform attacks were symptomatic of uræmia, although in certain details Rouillard's observation seemed to contradict this interpretation. Even admitting that they were veritable epileptic attacks, this would be by no means a reason for designating the trouble a scarlatinous epilepsy. He would hold further that it had not been proved that scarlatina played any rôle in the development of the mental troubles described by Rouillard. In reply Rouillard claimed that he had broached no theory, but had simply reported two cases, which were rare, and well authenticated; he had not spoken of scarlatinous insanity, but had only spoken of mental alienations developed subsequent to scarlatina; there was no scarlatinous insanity any more than there was a cardiac or a cancerous insanity. But it is still necessary to recognize that etiology is the principal factor in the classification of mental diseases. Without saying *post hoc ergo propter hoc* it is necessary, however, to take into account the conditions under which insanity develops. Is there an insanity consecutive to acute diseases, and

especially to eruptive fevers? And does this mental affection have special characteristics? Rouillard does not know, and does not wish to prejudice the question. Observations must be collected and facts grouped in order to be able to draw useful conclusions.

Auguste Volsin recalled two cases of Bright's disease, in the course of which there had been several epileptiform vertigos, followed by hallucinations; by melancholic delirium, characterized especially by the idea that they were not at home, not recognizing their furniture, nor their pictures, nor their rooms.

THAYER, *A case of melancholia following typhoid fever*, Johns Hopkins Hospital Bulletin, 1892 III. 12.

Twelve days after the patient's temperature had become normal in his convalescence, he appeared for the first time to be nervous and anxious about his condition. Asked if he was very ill and if there was any chance of his recovery, saying one of the patients had told him he was very ill. Fifteen days after the temperature had become normal, his physical condition having steadily improved, and the diet having been increased to nearly normal proportions, he was allowed to sit up for a short time out of bed. On the same evening he was found to be in a very nervous condition. He was despondent, weeping, and when the physician came by, seized his hand and begged him to save him. He declared that he had seen the head nurse read the order that he was to be cremated that evening, and had also seen her receive the announcement that the box in which the operation was to be performed had arrived and was stored in the room below. The patient became more silent and despondent, and was discharged two weeks later in a distinctly melancholic condition.

Dr. Hurd, in the discussion, said that such cases of insanity after any exhausting bodily disease were not uncommon. Insanity developed after the eruptive fevers, pneumonia, acute tuberculosis, typhoid fever, and in fact any sequel which interfered with the nutrition, assimilation and blood-making power of the patient. The delusions of such patients were those which accompany innutrition, and were characterized by suspicion and apprehension. The deficient blood supply to the brain, or rather the altered quality of the blood supply by reason of the preceding bodily disease, explained the delusions. The development of post-febrile insanity generally points to an hereditary tendency to mental disease. The presence of this insane heredity developing active disease under such circumstances lends an unfavorable prognosis in most cases. Sometimes they recover, but the majority develop chronic forms of insanity.

Dr. Osler said that in his experience, especially after typhoid fever, the prognosis was favorable, and cited several cases reported by him in Fasciculus I. of the Johns Hopkins Hospital Reports for 1890, where apparent recovery from mental disease after a tedious convalescence occurred.

MAIRET ET BOSCH, *Recherches sur les causes de la toxicité de l'urine normale*, Arch. de physiol. norm. et path. 1891 III. 273.

A reference to the experiments of these authors on normal urine will be of service in considering the results obtained from the urine of the insane. Rabbits and dogs were used in the experiments. Injections were made in the femoral vein of the dog and the auricular vein of the rabbit. Fresh urine from persons 22 to 33 years of age was used, the individuals being of almost the same body weight and living in the same average conditions. With regard to the degree of toxicity, it requires 100 cc. of urine per kilogramme of body weight to kill a dog. With this dose the animal succumbs immediately or after some hours.

Below this amount the animal may be more or less fatigued, but he does not die. In the rabbit 90 cc. cannot be injected without producing immediate death, but this may come on with smaller doses, between 70 and 80 cc. per kilogramme of body weight. In doses below 100 cc. the dog survives, but with the rabbit, below 70 cc., and even at 45 cc., the animal may survive or not, showing besides an immediate toxicity a remote toxicity. If these two kinds of toxicity are considered, it is seen that in the rabbit the degree of toxicity oscillates between 45 and 90 cc. per kilogramme of body weight, being on the average 67 cc. The effects of the urine were in general the same in the dog and in the rabbit. Taking the rabbit as a type, it is found that in all doses, even when the amount injected does not exceed 25 cc. per kilogramme of body weight, myosis is produced, but in small doses the myosis is but little marked, and is transitory; with larger doses it is more persistent, and the pupil becomes punctiform. With all doses there is abundant and clear micturition, which may be equivalent in quantity to the amount injected. The animal also shows thirst. Respiration is slowed. There is constant subnormal temperature, even to 3° or 4° C. Troubles of the nervous system consist, according to the doses, in somnolence, coma and epileptiform attacks, preceded or not by convulsive movements.

In studying the different constituents of the urine, to find the cause of the toxicity the authors conclude that it is the coloring matters that exert the chief toxic effect. To the objection that the coloring matters include at the same time some alkaloids, the authors cite the experiments of Pouchet and of Bouchard, to the effect that these substances are present in very feeble quantity in the urine, and Bouchard states that they have no influence on the toxicity of the urine. As regards the ptomaines, *Æscher* and *Cornineck* state that they did not find these in normal urine. The coloring matters are, therefore, the essential cause of the toxicity of the urine. The salts of potassium also aid in the toxic effect, while the urea, the salts of sodium and potassium, and the water, have an effect on the micturition, while the salts and the water aid in the respiratory troubles, and the salts of sodium in the circulatory troubles.

MAIRET ET BOSCH, Alienation mentale par troubles de la nutrition, preuves expérimentales de l'existence de ce genre d'alienation, Annales medico-psychologiques 1892.

In attempting to ascertain the genesis of certain cases of mental alienation and to study their causes, it is found that these cases are developed subsequent to some grave physical disease, such as typhoid fever, or during the puerperal state, or again at certain periods of the evolution of life, as at puberty.

In these cases it is natural to connect the insanity with these physical perturbations, and this with all the more reason since no other cause is found susceptible of explaining the mental alienation, and that the form and evolution followed by this mental disturbance have special features. The majority of clinicians admit this subordination. Yet the opinion has its adversaries, and is lacking in scientific proof. The authors claim that they have furnished this proof by experiments made of the toxicity of the urine of the insane. In this connection they have studied successively the toxicity of the urine of patients affected with mania, stupor, melancholia, the insanity of persecution, and senile dementia. As much as possible of the 24 hours' urine of these patients was collected, and from this was taken the quantity necessary for the experiments. As subjects of experiment, the dog and rabbit were used, more particularly the dog, whose nervous system is more developed, and whose reaction is more sensitive and more complete than that of the rabbit. The intravenous method was used, according to the rules for-

mulated by the authors in their researches on normal urine (*Comptes rendus de la Société de Biologie*, Dec. 13, 1890, and in the *Archives de Physiologie*, April, 1891). The results obtained with normal urine served for comparison of the effect of pathological urine, the results being tabulated for comparison. The comparison was made from two points of view, from that of the degree of toxicity and from that of the toxic qualities, i. e., of the action of the urine on the different functions of the economy, digestive tract, respiration, circulation, temperature, pupils and nervous system. In the first part they analyze the principal results obtained for each form of mental alienation, referring for details to a work they are about to publish on the toxicity of normal and pathological urine. In the second part they compare the results with each other in making the synthesis. They claim that this synthesis furnishes the scientific proof that the physical perturbations that they describe may give rise to the mental alienation, and they establish the nature of this alienation. The experiments on the urine of maniacal patients were conducted on thirty-three patients, twenty-five of the agitated type, eight being quiet. In mania without agitation five experiments were made on rabbits and three on dogs. In the two cases the results had a great resemblance to those for normal urine. The urine of non-agitated maniacal patients was, perhaps, a little more energetic in the sense that in the dog for example, myosis was produced by doses which normal urine did not produce, and the enfeeblement was more marked.

In mania with agitation the results are divided into two groups, the division being independent of the agitation. From the first group of ten patients the urine of three patients was injected into rabbits, and of seven into dogs. The results were in general the same in the two species of animals.

In comparison with normal urine the following facts came out: (1) As regards the degree of toxicity. The urine of agitated maniacal patients is considerably more toxic than normal urine. In the rabbit with normal urine death was never produced with less than 45 cc. per kilogramme of body weight, while with the urine of agitated maniacs, death followed twice with 25 cc. Again, in the dog it took 100 cc. of normal urine to kill the animal, while 30 cc., and even 25 cc., sufficed when the agitation was considerable. (2) As regards the characteristics. In general these are the same for myosis, micturition, respiration, circulation, temperature, nervous system, the manner of death, and the pathological findings. There was a little less hyper-excitability, and a slight hyperæsthesia at the upper part of the limbs. The urine of this first group of maniacal patients showed but little difference from normal urine, except in its greater toxicity.

The second group consisted of fifteen experiments on the urine of four patients, in whom the agitation was considerable, but not surpassing that of the patients of the first group, of whom four, in particular, were in a state of excessive agitation. Compared with normal urine this second group showed a considerable increase of toxicity, 25 cc. sufficing to kill the rabbit at once.

With regard to the characters of the toxicity the action of the pupil was more intense than with normal urine. Urinations were less frequent. Respirations were affected in the same manner, but the convulsive troubles are still more marked. The circulation is disturbed in the same manner. Body temperature is in general subject to the same modifications, i. e., there is a subnormal temperature, but the fact is less constant; in some cases, on the contrary, there is a rise of temperature.

On the side of the nervous system, together with similar symptoms, among which is weakness, the following differences are to be noted:

1. A high degree of convulsibility. The attacks, even in the dog, succeed each other rapidly, the slightest touch on any part of the body of the animal producing convulsive seizures, which may, in certain cases, become generalized.

2. An enormous muscular and tendinous hyperexcitability, and a very marked hyperæsthesia. Comparing the effects of the urine of the second group with that of the urine of the first group, it is found, with regard to the degree of toxicity, that these two kinds of urine resemble each other, while with regard to the toxic qualities there exist between them the same differences that were found in normal urine. Further, while in the first group the toxicity of the urine is notably diminished, disappearing even when a quiet period comes on; in the second group this toxicity may continue again very marked and with the ordinary characteristics, even when the patients are calm.

3. Stupor. The experiments are here divided into two groups relative to their toxicity; the first group is formed by cases of simple stupor, the second by cases of melancholic stupor. In simple stupor the degree of toxicity is a little more marked than normal; 60 cc. per kilogramme of body weight are sufficient to produce death, where it required 100 cc. of normal urine. The toxic qualities are in a general manner similar to that of normal urine. The sole difference, apart from the temperature, which may be affected in another manner, consists in a muscular hyperexcitability. In melancholic stupor nine experiments were made, six upon dogs, three upon rabbits. With regard to the degree of toxicity this is considerably increased; 25 cc. sufficed to kill a dog. The toxic qualities are the same for the other functions of the body except the nervous system, but here there are other symptoms manifested by inquietude and by stupor, resembling the condition of the patients who have furnished the urine. The action of the urine of melancholices compared with that of normal urine shows both resemblances and dissimilarities. The dissimilarities are with regard to temperature, which varies in both directions more than with normal urine; secondly, a diminution or even abolition of the sensibility, not occurring with normal urine; thirdly, psychomotor troubles; fourthly, the degree of toxicity of the urine of melancholia is considerably greater than with normal urine, 30 cc. and even 25 cc. sufficing to produce death. The greater toxicity and these different qualities have no relation with the density. In the insanity of persecution, when the individual is not agitated the toxic qualities are the same as in normal urine, but when the individual is agitated the toxic qualities are a little greater. The urine of senile dementia presents no special characteristics.

The following are the conclusions with regard to the degree of toxicity: In all the forms of mental alienation except senile dementia, the degree of toxicity of the urine is increased, but in very different proportions, according to the form of alienation and according to the acuteness of the disease. While in mania without agitation there is a degree of toxicity similar to that of normal urine, and in simple stupor and the insanity of persecution there is a relatively feeble degree of toxicity, melancholic stupor, melancholia, and mania with agitation on the contrary have a much greater toxicity. The form of the disease seems to be only a secondary element in the toxicity of the urine, the primary element being the intensity of the disease. In mania when the patient is agitated the toxicity of the urine is considerable; when he is calm his toxicity does not exceed the normal. With regard to the toxic qualities the experiments may be divided into two groups; in the one there are symptoms which do not exist in normal urine; in the other there are no new symptoms, but certain troubles which are produced by normal urine assuming an exaggerated importance.

In the second group there belong mania with agitation, simple stupor, and the insanity of persecution. In these cases, in fact, apart from a certain degree of muscular hyperexcitability and a slight amount of hyperæsthesia, the symptomatology is similar to that of normal urine, the enfeeblement and the prostration simply being more marked.

In the first group belong mania through nutritional troubles, melancholic stupor and melancholia. The cases of mania of this group show a hyperæsthesia, a muscular and auditory hyperexcitability, and a state of convulsibility that is not found with normal urine.

In cases where the pathological urine only reproduces the symptoms of intoxication by normal urine the degree of toxicity is closely connected to the greater or less intensity of the disease. In mania it is associated with the agitation, in stupor to the depression. When, on the contrary, the pathological urine gives rise to new symptoms, the toxicity persists in its principal characteristics, although the intensity of the disease has diminished, and only disappears when the individual has completely recovered his normal state. Consequently, while in the first case the toxicity of the urine is associated, not to the cause of the disease itself, but a secondary element—the acuteness, in the second case it is intimately associated with the disease itself. There is thus an essential difference between the diseases of the second group and those of the first. Studying these two groups from the etiological point of view, the causes may be divided into two groups: the ordinary causes of the neuroses, and secondly, such causes as infectious diseases, the puerperal state, puberty, etc.

Associating these etiological facts with those obtained from experimentation, it is seen that those cases which have as causes the ordinary causes of the neuroses, are those in which the toxicity of the urine is allied to a secondary element, agitation or depression, while those which are caused by a profound mental trouble are the cases in which the toxicity of the urine appears to be allied to the cause of the disease itself. Experimentation, therefore, appears to confirm that which is indicated by the study of the causes, and to show the existence, in addition to the neurotic mental alienations, of mental affections of another character. Experiments, however, do not warrant us in going farther and determining the exact nature of these mental alienations. It is of little consequence what physical cause has given rise to the insanity, the puerperal state or infectious diseases, the urines always produce the same toxic phenomena. Consequently, it is not to the typhoid or puerperal poison, for example, that it is necessary to assign the mental alienation, but to some other element common to all these perturbations, and as the sole common element is the trouble brought on by nutritive disturbance, we are forced to assign these mental alienations to this trouble. Consequently, in addition to nervous mental affections, a place should be assigned to *mental affections through troubles of nutrition*. The experiments, therefore, appear to the authors to have a double interest. (1) They confirm scientifically the opinion that certain physical disturbances may give rise to mental alienation. (2) They unite in the same group, *mental alienation through troubles of nutrition*, the mental alienations studied by authors under the different names which have been the causes capable of producing them: puerperal insanity, insanity of pubescence, etc.

FOLSOM, *Some points regarding general paralysis*, Boston Med. and Surg. Journal, Sept. 3, 1891.

Of the many divisions of general paralysis into several clinical types, all of them naturally more or less arbitrary, Folsom considers Meynert's

eight the most satisfactory (*Klinische Vorlesungen über Psychiatrie*, Wien, 1890, Braumüller).

(1) Simple progressive dementia, with the usual progressive motor impairment which accompanies it.

(2) With delusions of grandeur and with marked motor disturbances, which appear simultaneously and are progressive. The mental state is usually of exaltation, but there may be depression.

(3) Of the same type as the last, but falling its steadily progressive character, that is, with remissions.

(4) Cases in which the characteristic exaltation and grand delusions reach such an astonishing height that the manifest motor symptoms are looked for with confidence from day to day, and yet may not appear even for a year, any slight incoördination naturally being obscured by the general muscular disturbance. Meanwhile there may be such an improvement as to simulate a recovery.

(5) A very rare form with alternate symptoms of exaltation and depression.

(6) With early furious delirium, painful hallucinations, confusion and incoherence somewhat resembling acute delirium.

(7) In which the characteristic indications appear secondary to other forms of insanity, for instance, after paranoia or melancholia.

(8) The combined form, with sclerosis in the whole cerebro-spinal tract, the symptoms of tabes or spastic paralysis predominating, according as the posterior or lateral columns of the cord are chiefly involved. The ascending type, in which the cord is first affected, is rare. Optic neuritis, ending in atrophy and paralysis, especially of the ocular muscles, may precede marked mental symptoms.

In Paris in 1874, and chiefly by Sander in Berlin in 1876, attention was called to a period in general paralysis in which there are vague signs of mental failure for a varying length of time, perhaps for several years antedating the pronounced symptoms. This early stage is most marked in Meynert's first class, the demented type, to which the recent great increase in general paralysis belongs.

Of the different pathological designations of the disease, chronic meningo-encephalitis, chronic diffuse periencephalitis, Folsom prefers chronic diffuse cortical encephalitis, whether primarily interstitial or parenchymatous, ending in greater atrophy than occurs in any other form of insanity. For the microscopic changes found in the cortex the description of Mendel is quoted (reviewed in this Journal, III. p. 560).

Folsom calls attention to the fact that the post-specific cases, with a previous history of specific disease not recent, those not only not benefited by iodides and mercury, but usually debilitated and injured by them, may exhibit post-mortem the same microscopic changes as those in which there is no ascertained evidence of syphilis. In paralytic dementia, with a recent history of syphilis also, and with marked indications of specific disease, where anti-syphilitic remedies avail to produce such an amelioration of symptoms as to simulate a cure at least for a time, the same diffuse cortical changes may be found at the autopsy-points, which, in making and verifying diagnoses, should be borne in mind as well as the facts that there are degenerative changes in the brain secondary to gross syphilitic lesions, which do not constitute general paralysis, and that the several types of general paralysis and other conditions of cerebral atrophy exhibit post-mortem appearances which may so gradually shade off into each other as to make the analogy very close. In senile and chronic simple insanity, the atrophy of the nerve fibres is primary, while in paralytic dementia the essential process, according to Obersteiner, is a diffuse primary sclerosis of the cortex, which leads to atrophy, which appears in the frontal lobes first. Folsom follows Obersteiner's view that the sclerosis is preceded

by a condition of irritation which seems to justify the expression, chronic periencephalitis, although the brain-coverings play only a secondary rôle. Obersteiner's views that the "spider cells" are formed from wandering leucocytes, are quoted, together with his description of the processes leading to fibre-atrophy. Healthy and diseased cells and fibres being seen side by side, the early symptoms do not constitute a paralysis, but a cortical ataxia, a motor intelligence-disturbance on the one hand, and on the psychic side mental failure due to defective association of ideas through greater or less affection of the association-fibres of the cortex. Further than that we can scarcely yet be said to know much about the relations of pathological conditions to abnormal mental manifestations in general paralysis, except so far as the final atrophy explains the intellectual and physical decay. Folsom's description of the prodromal stage of general paralysis has already been reviewed in this Journal (Vol. III. p. 557).

CUYLITS, *Surmenage et folie paralytique*, Bulletin de la Société de Médecine mentale de Belgique 1890 p. 271.

In this article the author attempts to make good his assertion that overwork, traumatism, the abuse of alcohol and tobacco produce no bad effect in a sane man. They may produce some form of mental alienation in a nervous hereditary subject; they may produce general paralysis when this hereditarily predisposed subject is syphilitic from birth or when he becomes so later. In assigning this specific origin to general paralysis he classes it with the diseases by intoxication of the same kind as the nervous accidents due to typhoid fever or diphtheria. The author urges that it is not easy to demonstrate by facts and arguments that overwork may of itself be able to cause general paralysis. He thinks that if a particular case is cited as a case of general paralysis from overwork that, unhappily for the demonstration, it would be difficult to establish the fact that he was not at the same time an hereditary subject, and on this account the observation would be without value. The contention of the author is that the normally endowed man cannot overwork, fatigue acting as a sort of safety valve, producing sleep in time to save the brain. If a man, apparently sound and healthy, with no sign of degeneration, overworks and becomes insane, he is *ipso facto* a degenerate, else he would not have broken down, and you have not looked deep enough for the signs of degeneration. Criticism is simply powerless before such an argument.

CHEVALIER, *La paralysie générale à l'asile de Dijon* (de 1843 à 1889), Thèse de Bordeaux 1889-1890 No. 52.

From a statistical study of the records of the Dijon Asylum, Chevalier concludes:

1. The number of general paralytics has risen during 30 years from 13% to 20% for the men, and from 5% to 7% for the women.
2. The proportion is four times greater among the men than among the women.
3. The number of married paralytics is double that of the unmarried.
4. The average age is 38 years for the men and 40 years for the women.
5. There were no paralytics under 21 years.
6. From 20 to 25 the proportion is 1-5%.
7. The laboring class furnished about 30% of the number of paralytics; the commercial and industrial classes 25%; the liberal professions 5% (Dijon is a public asylum).
8. Among 163 paralytics whose hereditary and personal antecedents were established, there were 1-5 with an alcoholic heredity; 1-5 with a congestive and insane heredity; 1-13 with a history of syphilis.

Comparing these numbers with those given in the thesis of Dr. Talon, who has given a report covering the same period of years for the Marseilles asylum, it is found that the number of women relative to the number of men is a little larger at Marseilles than at Dijon.

The average age at the time of entrance presents an inverse relation at Dijon and at Marseilles, where the figures are 45 years for men and 35 for women. The number for the professions was the same at Marseilles and at Dijon.

Chevaller's general conclusions contain nothing new, and are in accord with the ordinary views on the subject; his conclusions are if it has been shown that general paralysis occurs with increasing frequency in connection with the conditions of existence, from whence arises an over-exertion increasing from day to day, it still must be recognized that this progression is not so great as certain authors have affirmed. If it is well established that the maximum frequency of the appearance of general paralysis is between 35 and 45 years of age, as all alienists claim, it has been equally shown that general paralysis at the extreme limits of life is not an exception, and the limits of its appearance increase every day. With regard to the researches into etiological causes there were such complete *lacunæ* in certain cases and in others such obscurities, reticencies and false statements as to render any practical conclusions impossible.

BLACKBURN, *A study of nineteen cases of general paralysis of the insane*. Report of the Government Hospital for the Insane, Washington, 1891.

All the cases were males, fifteen white, four colored. With possibly one exception all were characteristic in symptoms and in the lesions found post mortem. The skull was thicker than the average in seven cases; it was noticeably dense in five; thinner than usual in five. Various degrees of asymmetry, usually very slight, were observed in at least twelve cases. The horizontal outlines of eighteen of the crania are shown in two plates. The dura mater was abnormally adherent to the bone in six cases; the inner surface showed evidences of internal pachymeningitis in six cases. The heaviest brain weighed 51½ ounces; the lightest weighed 34 ounces; the average weight was 43½ ounces.

Marked changes in the pia and more or less shrinkage of the convolutions were found in nearly all the cases. The meningeal and atrophic changes were usually more decided in the frontal portions of the hemispheres. In thirteen cases the pia showed adhesion to the cortex; in the remainder the membranes were removed with even less difficulty than from the normal brain. The microscopical appearances were characteristic in nearly every case. As a rule the microscopical changes were of greatest intensity in sections from the fronto-parietal convexity, though occasionally the hippocampal regions showed the most decided changes.

In the majority of cases slight vascular and other changes were found in the cerebellum. The pons and medulla were diseased in all the well-marked cases. Slight sclerosis of the spinal cord was found in several cases. The report is accompanied by four excellent photographs of parietal brains.

FROELICH, *Deux fractures spontanées chez un paralytique générale*, Revue méd. de l'est, 1890, XXII. 561.

The author cites the opinion of J. Christian in the *Dictionnaire des sciences médicales* against the alleged exaggerated tendency to fractures in general paralytics, Christian not having seen a single fracture in five years in 307 paralytics. Also, Simon in his thesis *Des Fractures Spontanées*, 1886, asserts that spontaneous fractures are very rare in general

paralysis, most authors mentioning them, but without offering any proof, there existing only a small number of observations that are truly conclusive, and most of the authors failing to distinguish, from the point of view of the production of these fractures, between dementia and general paralysis.

Froelich's case was that of a man of 43 years, who presented himself as an out patient, having a fracture of both bones of the fore-arm. Three days before on lifting a shovelful of dirt he felt a slight pain in his arm and at the same time heard a slight cracking, but he continued his work.

The clinical history as given by Froelich leaves no doubt that the patient was suffering from general paralysis. That the fracture was really spontaneous there seems to be no doubt, since shoveling dirt would not produce a fracture in a normal man. The manipulations necessary for putting the arm in a plaster dressing caused no pain to the patient. The patient returned five weeks later to have the plaster removed; union was complete. At the same time he showed his right arm, and examination showed that the two bones of the fore-arm were broken. He had slipped on a flight of stairs, and in falling struck with the back of hand, not very strongly, on some coal in a basket that he was assisting in carrying. The traumatism here was more considerable than in the first instance, but the shock was not violent and he did not know that he had broken any bones.

The points of interest are:

1. In a general paralytic, whose disease had existed over 6 months, two spontaneous fractures occurred at intervals of 5 weeks.
2. These fractures caused no pain to the patient at the moment of their production, nor at the time of their reduction.
3. The union was rapid, as has already been noted for this class of fractures.

BUDDEBERG, *Ueber die akut verlaufende depressive Form der Dementia paralytica*, Allg. Zt. f. Psychiatrie 1890 XLVI. 682.

Within a short period Buddeberg observed five cases of the depressive form of general paralysis. On entrance all three cases presented the classical picture of agitated melancholia; only in three cases was there a certain diminution of memory. Patients complained loudly of their misery, wrung their hands in despair, ran unsteadily about, and refused nourishment; hypochondriacal complaints were more rarely shown. After a short time there developed in all the cases signs of a profound organic lesion of the brain, as shown in difference and immobility of the pupils, pareses, etc. To the parietic symptoms there was added a rapid loss of mental powers, nutrition was greatly reduced, and on the entrance of intercurrent, febrile diseases, the disease ended fatally in the course of a few months; only one case lasted eleven months. Autopsies in four cases; the brains in general showed signs of a very acute encephalitis, the cortical substance being already in part atrophied. A cystoid degeneration of the cortical substance such as Schüle and Ripping have described for this form was not observed. As regards etiology four cases were hereditarily predisposed. Besides *trauma capitis*, mental over-exertion and work appeared to be important predisposing causes, but the number of cases is too limited to permit definite conclusions to be drawn. Patients all males.

COTTAM, *A case of general paralysis of the insane with crossed reflexes*, Lancet 1891 II. 288.

The patient was a male, age 55. The clinical history presented the usual mental and physical signs of general paralysis. The particular symptom of "crossed reflexes" was noticed after the disease had

advanced to the stage that compelled the patient to be kept continually in bed. At this time, in addition to the exaggerated knee-jerks, it was noticed that tapping of either patellar tendon was associated with a contraction over the outer and upper part of the opposite thigh in front. This crossing occurred with both knee-jerks; but on tapping the left patellar tendon, the contraction on the right thigh was more marked than that on the left thigh, which followed tapping of the right patellar tendon. That this was not due to what Ross calls the "physical diffusion of vibration" was, Cottam thinks, shown by the fact that the contractions could be plainly felt as well as seen, and also that the crossed contractions, which could almost always be elicited, occurred after the ordinary reflex. Again, the plantar reflexes were faint, but associated with the same phenomenon, the "crossed contractions" occurring in the same locality as in the case of those following the knee-jerks. "Front tap" contractions could be obtained, and these also brought out a precisely similar "crossed contraction." Ankle-clonus was faintly present, and there was not any crossing. Of the other reflexes, none of which showed any associated crossing, the inter-scapular, abdominal, and epigastric were absent, the gluteal brisk, cremasteric faint, and the pupillary sluggish. No autopsy could be obtained. Prevost, who has reported a similar case of crossed reflexes, regarded the crossing as due to the physical diffusion of the vibration, for he found that "section of all the nerves and posterior nerve roots of one limb of an animal does not abolish this crossed contraction." With regard to the two theories regarding the nature of the knee-jerk, Cottam considers that his case is an argument in favor of the theory that holds the knee-jerk "to depend on a centre in the spinal cord," as against the theory that the "contraction of the quadriceps is due to local irritation of the muscles from sudden elongation," and he asks how we are to account for the contraction in the opposite limb if the contraction depends on local muscular irritation. He denies the probability of any vibration, and thinks that the only diffusion that occurred was from the one to the other side of the spinal cord itself.

GARNIER, *La folie à Paris, la progression crrélatiue de la folie alcoolique et de la paralysie générale*, Annales d'hygiène publique et de médecine légale 1890 (3) XXIII. 5.

1. Statistics show that the number of the insane in Paris has increased in recent years in very strong proportions. the frequency of insanity having increased about 30% from 1872 to 1888.
2. Mental alienation is more common in men than in women (men 55.6%, women 38%.—General statistics of the préfecture de police).
3. The statistics of the increase of insanity for the two sexes in the triennial period, 1886-1888, is for men 59.35%; for women 40.64%.
4. Insanity considered as a whole and with regard to its monthly movement regularly attains its maximum frequency each year in June, and its manifestation or the development of the period of access, both among men as among women, seems to be favored by the influence of spring.
5. The increase of cases of mental disease in recent years is first of all shown in two types, whose frequency has increased very rapidly, alcoholic insanity and general paralysis.
6. The increase of alcoholic insanity is so rapid that its frequency is to-day twice as great as five years ago, and the commitments have increased 25% in the course of the last triennial period. It forms almost a third of the cases of mental diseases seen at the special infirmary.
7. Females have a proportional participation in this increase, and this participation tends to become greater and greater.
8. The frequency of alcoholic insanity is subject to strong monthly

variations. It does not reach its highest limit during the hottest months; its increase appears to correspond to the influence of spring, with the monthly maximum in June.

9. Observation of the delusional forms of alcoholism shows that the reactions that develop under its influence are becoming more violent from day to day and are accompanied by more attempts on the life of individuals, consequences that it is legitimate to attribute to the alcohol-holds of commerce actually in use.

10. General paralysis, which is with alcoholic insanity the morbid form whose increase is the most rapid, comprised 12.27% of the total patients examined at the *dépôt*. In five years its frequency has more than doubled.

11. It tends to become proportionally more common among women than formerly; the relation which was five years ago, men 79.60%, women 21.39%, is to-day men, 71.17%, women 28.82%.

12. As with mental disease in general, so with alcoholic insanity, but still more than any other morbid form, the greatest number of admissions of general paralysis is in springtime. Its increased recrudescence takes place in May, and is very markedly vernal.

13. The comparison between the curves showing the simultaneous increase of alcoholic insanity and of general paralysis shows that their rapid progression is plainly correlative. In the close relationship of their course the etiological influence of alcoholism upon the development of diffuse interstitial encephalitis appears to be manifest.

DARRICARRIÈRE, *La paralysie générale dans l'armée*, Thèse de Paris, 1890 No. 61.

This thesis is a study of the statistics of general paralysis in the army during the 10 years from 1878 to 1888. To the question whether statistics carried out on all men between the ages of 35 and 55 in civil life and on soldiers of the same age—manifestly the only legitimate method of arriving at results—would be to the advantage of civil or military life, he is unable to give a satisfactory answer.

ACQUÉRIN, *Contribution à l'étude médico-légale de la paralysie générale*, Paris 1891.

In a pamphlet of 74 pages Dr. Acquerin discusses the medico-legal relations of general paralytics, especially in relation to the early or prodromal stage, which he calls, not without justice, the *période médico-légale*. As the discussions of the responsibility of paralytics and of pseudo-paralytics have special reference to the French *code pénal* and *code civil*, they have but little bearing on similar conditions arising under English and American laws. Examples are given of crimes and misdemeanors committed by general paralytics, and examples of the status of such patients in marriages, contracts, life insurance and wills.

ZACHER, *Ueber zwei Fälle von acuter Paralyse*, Allg. Zt. f. Psych. 1891 XLVIII. p. 188; Neurol. Centralbl. 1891 X. p. 68.

The author reports two cases of acutely progressing paralysis, in which the first, after a melancholic prodromal state, ran its course in less than four weeks; in the second the duration of the disease was about two and a half months. In both cases, besides a relatively slight change in the vessels and in the interstitial tissue, there was a fairly extensive and high degree of fibre atrophy. From this the author concludes that there are cases of paralysis where the fibre atrophy is the primary process in the anatomical changes.

Hertz considered that the two cases must be classed as *dellrium acutum*, and expressed a caution against the too great extension of the

field of general paralysis. To the question whether the two cases might not be considered as an acute infectious brain disease, the author thought that this was disproved by the long prodromal stage in one case and the failure of all evidences of infection at the examination of the internal organs. Also up to this time, as Fr. Schultze has pointed out, no fibre atrophy has been found in the brain in acute infectious diseases.

ROCQUES, *De l'alcoolisme et de la paralysie générale*, Thèse de Paris, 1891 No. 230.

For a number of years general paralysis and alcoholism have shown a progressively ascending scale in Paris. The curves of the two diseases show a parallel course. Authors are divided upon this question. Some (Foville, Garnier) think that alcoholism is the cause of this increase of general paralysis, while others (Lasègue, Ball, Christian and Ritti) on the contrary think that alcoholism is only an accompanying factor, a symptom of the initial period of general paralysis, during which the patient under a general excitement gives way to excess of drink. Rocques holds to this last opinion. When the alcohol is eliminated and the alcoholic delirium has disappeared, the general paralysis alone comes to observation and continues its slowly progressive course. There are a great many patients classed as alcoholics who should be classed as paralytics. This error in statistics shows the proportion of paralytics to be 20% of insane patients instead of 27% as it should be, and is the cause of a corresponding increase in the proportion of alcoholics. It is necessary to reserve a diagnosis at the outset, since the prognosis of alcoholism is often favorable, while that of general paralysis is fatal. The responsibility of the alcoholic is a subject of discussion, while that of the paralytic is fixed.

Although alcoholism and general paralysis increase with parallel steps in urban districts, such as the department of the Seine and that of the Rhone, and although they are both rare in agricultural regions such as Lozère, yet in certain alcoholic countries there is proof of the rarity of general paralysis. This is the case in Finisterre, one of the departments where alcoholism plays the greatest ravages, yet where general paralysis forms only 0.62% of the cases of mental disease. The same facts are observed in countries that are manifestly alcoholic, such as Ireland, Scotland, Sweden and Norway, and Canada. Alcoholism may lead at length to general paralysis, alcoholics may beget children predisposed later to general paralysis. When general paralysis develops in an alcoholic, it assumes a special form, pseudo-general paralysis (Westphal), which is distinguished by numerous characteristics and especially by the course of the disease. It may be cured, or it may relapse. True general paralysis recovers very exceptionally; remissions are observed, after which it continues. Pseudo-general paralysis may begin again.

REGIS, *Note sur le diagnostic différentiel de la lypémanie hypocondriaque et de la paralysie générale progressive*, Gazette médicale de Paris, 1890 (7) VII. 1,13.

Regis cites four cases in which there was difficulty in diagnosing between hypochondriacal melancholia and general paralysis. In his conclusions he gives the diagnostic points of different authors and then his own. The principal distinctive characteristics given by different authors are: 1. The hypochondriacal delusion of general paralysis has a particular stamp of absurdity, hebetude and incoherence. It appears suddenly, it is changeable and inconsistent. The patients do not argue and they speak without conviction, and they show but little zeal in complaining of their ills (Baillarger, Marcé, Voisin, Luys, etc).

The delusion of melancholia may be monotonous, but it does not present the same character of absurdity. The patient sees his disease, the reason, and the explanation, endeavors to convince, makes complaints, becomes angry with his contraditors.

2. In general paralysis the hypochondriacal delusion may be complicated at any moment with delusions of an ambitious nature. This is never the case in melancholia.

3. The hypochondriacal delusion of general paralysis is not favorably influenced by morphine, contrary to the case in melancholia (Voisin).

4. In general paralysis the subjects are not hereditarily predisposed. There have been no previous nervous disturbances (Mendel).

5. General paralysis, and consequently the hypochondriacal delusion accompanying it, come on between 35 and 45 years of age (Mendel, Mickle).

6. The examination of the organs is almost always negative in general paralysis (hypochondria *sine materia*), (Mendel).

7. In general paralysis there sometimes comes on from the beginning slight apoplecticiform or epileptiform attacks, pupillary and spinal symptoms (Mickle).

8. Subsequently, the signs of dementia paralytica can be established.

9. In anxious melancholia the hypochondriacal delusion is accompanied by ideas of damnation and of possession, by analgesia, by a tendency to suicide, and to voluntary mutilations, and by the fear of not being able to die. The delusion of negation and of enormity develops, and of the doubling of the personality (Cotard, Séglas).

These distinctive characteristics are far from being sufficient in practice to give certainty. And it is among the most important cases, those dependent on the nature of the delusion and on heredity, that they have the least value, since they may be found in both forms of the disease. Regis adds the following as being of some possible service:

1. Melancholia with hypochondriacal delusion is observed especially at an advanced age from 45 to 60 years. It is encountered more frequently among women than among men, in the proportion of eight cases to twelve, contrary to what is found in general paralysis. It is, like every psychosis, more rare among syphilitics than general paralysis, since the existence of a previous syphilis constitutes a presumption in favor of general paralysis.

2. The hypochondriacal delusion of melancholia does not appear at the beginning of the attack, but a longer or shorter time afterwards, some months or some years. It is constantly consecutive to the ordinary delusion of melancholia, especially to the delusion of imaginary culpability, which is the type. It continues associated to the delusion, and joins itself logically with it. It is tenacious, fixed and persistent. It is rarely accompanied by hallucinations; while on the contrary the terrifying dreams, the fear of death, the refusal of food, the tendency to suicide are almost the rule.

The patient is subject to paroxysmal crises more or less acute. During many years the intellect remains intact, the memory precise; the lucidity more or less great, sometimes complete.

3. The examination of the viscera is habitually negative; there is stomacic and intestinal inertia, constipation, frequency of the pulse, palpitations and more rarely other functional troubles. Emaciation is rapid; a true cachexia sometimes supervenes.

4. Recovery is possible; nevertheless patients may end in suicide, marasmus or the chronic state. It is especially in these last cases that one observes Cotard's delusion of negation, which appears to be the terminal stage of this form of melancholia.

In conclusion, Regis says that the hypochondriacal delusion as a special characteristic of general paralysis may be encountered in the

same form in anxious melancholia; that the diagnosis in these cases may present real difficulties; that, to solve the problem, it is necessary to bear in mind all the clinical elements of distinction.

ROUSSET, *Du rôle de l'alcoolisme dans l'étiologie de la paralysie générale*, Bull. med. de Paris 1891 V. 743; Gaz. d. hôp. Paris 1891 XIV. 871. (Abstract in Centralbl. f. Nervenheilk. 1891 Oct.).

At the session of the Congress of French alienists at Lyons in August, 1891, Rousset gives an extended review of this subject and makes clear the present position of the question. After showing the difficulties of the investigation of mental diseases because of the uncertainties of the clinical data, he reviews the different historical phases of the relations between progressive paralysis and alcoholism, showing the differences in definition that have been held on this subject among clinicians.

In the second place he treats of the errors which have often occurred, since the alcoholic excesses, which are very frequent in the beginning of general paralysis, were often taken for the cause of the disease. Twenty-two personal observations illustrate the different clinical varieties of alcoholic general paralysis. The conclusions of the author are as follows:

1. The rôle of alcoholism in the etiology of progressive paralysis has at all times been the subject of numerous controversies. The views of the authors may be classed in four principal divisions.

2. Certain patients considered as alcoholic paralytics began in fact in alcoholic excesses, but after the beginning of the general paralysis, so that these excesses are to be considered as results not as causes of the disease. This condition of recently acquired alcoholism need not therefore be taken into account in the causation of the meningo-encephalitis.

3. The correlative advances of alcoholism and general paralysis ought not to mislead us to the conclusion that one of these diseases has been produced by the other. The geographical and ethnographical relations do not seem to speak for the importance of alcoholism in the causation of progressive paralysis.

4. Extracts from the reports of all the asylum directors of France clearly show that the views of clinicians on this subject are still very much divided.

5. It appears that alcoholism plays a smaller rôle in the etiology of general paralysis than that uncertain, often unknown and impalpable "something" that is found in all diseases, and which seems to be a necessary condition for the development of the meningo-encephalitis, namely predisposition, which, according to the individual, may be cerebral, rheumatic and nervous, or alcoholic. In some, not very frequent cases, chronic alcoholism may bring on general paralysis without this predisposition, since it brings on a process of connective tissue growth and brain sclerosis.

Magnan of Paris opened the discussion by a clinical and anatomical demonstration of chronic cerebral alcoholism and insisted on the importance not only of the individual but also of the organs for the localization of the alcoholic lesions. For him there exists a general paralysis, but not an alcoholic general paralysis. The patients designated by this last name may be divided into three groups: first, chronic alcoholics with cerebral lesions; second, true general paralytics, who have remissions in the first stages of the disease; and third, the hereditarily degenerated, who under the influence of alcohol show cerebral symptoms which simulate progressive paralysis.

Régis of Bordeaux, from his observations in Castel d'Andorte, thought that it must be assumed that alcohol played only a secondary rôle in the etiology of general paralysis in the upper and middle classes of the

district; on the contrary from this point of view hereditary predisposition and syphilis seemed to him to be of manifestly greater importance.

Marie and Bonnet expressed similar views from personal statistical data, that especially alcohol more frequently than other poisons (lead, mercury, morphine), but in the same way as these, contributed to the development of the disease in the hereditarily affected.

Combemale referred to his observations made first at Montpellier and then at Lille on dogs that he had accustomed continually to alcohol drinking; between the fourth and eleventh months these animals manifested a series of characteristic physical and mental symptoms, and showed at the autopsy the same signs as progressive paralysis.

Christian disputed this similarity, and thought that in these cases there was probably an encephalitis which differed anatomically from the meningo-encephalitis of progressive paralysis.

MARIE, *Contribution à l'étude des troubles oculaires dans la paralysie générale*, Thèse de Paris 1890, No. 349.

The thesis of Dr. Marie contains nothing that is not already known about ocular troubles in general paralysis. His conclusions are that:

1. Ocular troubles (ophthalmoplegias, amauroses, etc.) are frequent in general paralysis. They have a special importance in that they may precede by several years the beginning of the affection.

2. These early troubles are transitory and incomplete in character.

3. Post-mortem examinations show that the initial diffusion of the lesion of general paralysis extends to the peripheral nervous system as well as to the portions of the cerebro-spinal axis.

Confusional Insanity.

In his review of Mental Diseases for 1891, in the Annual of the Universal Medical Sciences, Dr. Brush, in referring to the article by Connolly Norman on the subject of Confusional Insanity (see this JOURNAL, iv. p. 326), comments as follows on Wood's use of this term:

"It seems to us that Wood has somewhat overshot the mark in his attempt to simplify the nomenclature of insanity and its classification, and has incurred the risk of confusing distinct clinical forms of mental disorder. The term 'stuporous insanity,' for example, while applicable to a class of cases etiologically of the same origin, physical or mental exhaustion, disturbed nutrition or malnutrition, and auto-intoxication, conveys to the clinical alienist the idea of a class widely differing, in its clinical picture, from some of the cases he attempts to group together. The term 'stuporous,' while it describes an apparent state, is, we think, an unfortunate one. The majority of the cases are not stupid, but, on the contrary, alert and watchful. In some an overwhelming delusion of terror dominates, as it were, the patient, and prevents all attempts at spontaneity. In others, the impressions are normally received and interpreted, but response cannot be evoked. The patient is in some sense mentally paralyzed, but he is not stupid. We doubt not, indeed we know from observation, that cases which have been classed under the head of 'confusional insanity' were able to carry on distinct trains of reasoning, starting, it must be admitted, from false premises, but arriving at distinct conclusions; and these same cases have, after convalescence, been able to clearly recall the events and ideas of the so-called confusional period."

IRELAND, *Torquato Tasso; a psychological study*, Alienist and Neurologist, 1891 XII. 477.

This study is based upon the various lives of the poet Tasso, which we possess in Italian and in English. The writer calls special attention

to the fact that, in the case of this great and unfortunate man, we have fairly trustworthy data concerning his childhood, and are not left in complete ignorance of his ancestry. The vicissitudes of his family were not without their influence upon a child naturally precocious, and it is probable that the seeds of the melancholia, which afflicted him, were early sown. Tasso was a poet at seventeen, and, by the time his great work was ready for publication, the sensitive young man had suffered much from critics and censors. Dr. Ireland points out that the complaints of persecution, made by the poet, remind us of the smaller complaints of Jean Jacques Rousseau. We are given a description of Tasso's personal appearance, in which the following facts are to be noted: The orbits of the eyes were unusually large, the head large, the forehead high and sloping towards the top. He was short-sighted and had a slight stammer in his speech. From his own confession, he appears to have been over-indulgent in pleasures and rather fond of good wines. He had a tenacious memory, an unbounded ambition and love of glory, and a keen sense of injustice. He was proud, irritable, and deeply religious. And, added to all these, was the melancholia which often made him feel what he himself describes: "Something, I know not what, is whirling in my mind." These suspicions and aberrations made it impossible for his friends to ignore the affection which was evidently troubling him, so he was sent to a monastery to be taken care of by the monks, from which he escaped before his mental condition had much improved. While laboring under the idea that he was being persecuted, Tasso saw that many of his associates regarded him as insane. To the belief, widely current in Italy at the time, that the poet had gone mad through his love for the Princess Leonora, Dr. Ireland does not attach much credence. Some writers have held that the imprisonment of Tasso, which began in 1579, was the cause, instead of the result, of his mental derangement, but Dr. Ireland concludes that they fail to make out any good case. While in prison, Tasso was still in such a mental condition that he could bewail his misfortunes and overwhelm his friends with petitions. There can be little doubt of the poet's insanity at this time, for Tasso himself describes some "symptoms, the import of which no one acquainted with insanity can fail to read." He complains of the persecution of human and diabolical agencies, and is troubled by the apparition of spirits. His mind at times seems to have been much less unhinged than at others. His letter to Prof. Mercuriale, in the summer of 1583, contains his own account of his malady and the symptoms are unmistakable. Dr. Ireland concludes that Tasso was indeed affected with that form of insanity which is now called *paranoia*, characterized by a slow evolution of mental derangement, as shown by delusions of suspicion and persecution, hallucinations, and perversions of judgment. There appears to have been no hereditary neurosis in his family, but it is likely that the anxiety which Portia suffered before his birth and the griefs of his childhood helped the development of the mental derangement. After his release from prison the mind of Tasso seems still to have retained much of the great power that characterized it when unimpaired. The rest of the poet's life was filled with unhappiness and misfortune, and for two years, at least, after leaving his prison he was still subject to his strange delusions, and his actions at this time remind one of Swedenborg. He died, after a foreboding of his coming end, and after making the strange request that all the copies of the "Jerusalem Delivered," of which about twenty editions had been printed, should be gathered together and burned.

A. F. CHAMBERLAIN.

TURNER, *Asymmetrical conditions met with in the faces of the insane; with some remarks on the dissolution of expression*, Journal of Mental Science, 1892, XXXVIII. 18.

This is a consideration of "certain asymmetrical appearances, chiefly noticed in the face, by which we can actually demonstrate the existence of paralysis in a large proportion of all cases of insanity." Bilaterally associated movements have been chosen for study, because they are, as a rule, of equal strength on each side. Asymmetry of expression is not, of course, confined to the insane, but is to be found among nervous, excitable people, religious enthusiasts, and, though rarely, in normal individuals. It is possible for some people to "voluntarily produce a most marked asymmetrical condition in the contraction of the muscles of expression." In a case noted by Dr. Turner, there was "a strong tendency for the asymmetrical condition to become symmetrical," the subject needing to fix his attention entirely upon what he was doing in order to prevent the contraction becoming equally marked on both sides. "Inequality of the pupils is present in one-fourth of the cases of insanity on admission, and in chronic cases it becomes more common, and it is most common in general paralysis." It would appear also that "the right pupil is more frequently the larger, the difference being very slight in the recent cases, more marked in the chronic." From present evidence it is not possible to state definitely the precise locality in each hemisphere the paralysis of which has led to the asymmetry. "In 306 female cases, recent admissions, the tongue, when protruded, was deflected from the middle line in 80 instances, or 24 per cent." It would seem then that paralysis in the muscles that protrude the tongue prevails to about the same extent as it does in the muscles controlling the size of the pupils. The muscles of expression here considered are, in the upper zone of the face, the *occipito-frontalis* and *corrugator supercilii*, and in the lower, the *levator labii superioris* and the *zygomatics*. In the cases of fresh admissions asymmetrical action in the upper zone of the face bears to asymmetrical action in the lower zone, the proportion 3.7 to 1. Among idiots, and in all congenital cases of weak-mindedness, the lower zone is most frequently affected. In the cases of insane females the "frequency with which the muscles of expression of the lower parts of the face are called into play under emotional states, which would in the sane result in expression more confined to the muscles of the upper part," is noticeable. In other words, "their expressions are more animal-like, less mental." The paper is accompanied by a plate containing gravures of faces of melancholic and insane women, showing asymmetry of various regions of the face, and an explanatory chart.

A. F. CHAMBERLAIN.

KIERNAN, *Is genius a neurosis?* Alienist and Neurologist, 1892, XIII. (I) 118.

This is a review from the time of Aristotle to that of Lombroso, of the doctrine put forward by the Greek philosopher in these terms, "No excellent soul is exempt from a mixture of madness." The usual examples, chiefly from Lombroso, of the peculiarities and idiosyncrasies of genius are given. Shortness of stature, rachitis, excessive pallor, infirmities of the body, cerebral and cranial lesions, asymmetries, and abnormalities of the skull, stammering, left-handedness, celibacy, precocity, misanthropy, errand habits, etc. Dr. Kiernan concludes, "The alleged intellectual association of insanity and genius would seem, therefore, to be justified," but he is far from identifying the two. "Genius is not a product of morbid mind. In the exceptional instances where the two co-exist, the genius is evidence of a healthy, conservative

element struggling with the incubus of disease." He does not differ then to a great extent from Dr. Paoli, whose apt phrase, "genius with a neurosis" is better suited to the facts of the case.

RIGGS, *Extreme loss of muscle sense in a phthical patient*, Journal of Nerv. and Ment. Dis. 1891 XVI. 437.

Clinical case, 10 year old girl, phthical, sensation everywhere perfect, reflexes normal, muscular co-ordination of upper extremities normal, but co-ordination of the lower extremities was noticeably wanting, especially in the muscles of the feet. Treatment by electricity and tonics, recovery from the astasia, but death from phthisis.

Another patient with the usual symptoms accompanying phthisis had lost the power to use the right forearm and hand; death from phthisis. The connection between phthisis and multiple neuritis seems well established.

A. H. PEIRCE.

Harvard.

NOBLE, *Report of a case of anæsthesia of the right side*, etc. Jour. Nerv. Ment. Dis. 1891 XVI. 238.

Patient, twenty-nine years old, had suffered from rheumatism, which had left him with a somewhat involved heart trouble. Upon an occasion of unusually violent exertion he was attacked with anæsthesia of the right side. This was soon succeeded by hyperæsthesia of the same side with paresthesia of the left side. The symptoms manifested were probably due to reflex action from preputial irritation.

A. H. PIERCE.

Harvard.

G. S. WEIR MITCHEL, *Doctor and patient*, p. 177.

The doctor should not dig up his patient's symptoms. Before and after illness is the time to cultivate those inner morals which pain and weakness usually kill. Women are prone to confess too much to the physician, and illness breeds a passion for confessions and even for distortion. Women warp morally if long nervously ill. Physicians of all centuries have probably agreed most on rest, diet and exercise. The best do what is right, but often give foolish reasons for it. All always look beyond drugs. Instruments to measure temperature, pulse, etc., have improved the doctor's hand, eye and judgment. The doctor must not read the riot act to feelings nor poultice them too much, must not be too sympathetic and must be the grave of all secrets. Few things are so delightful as convalescence. Numberless tissues and molecules are being restored, more rapidly than in the growth of childhood. The physician who has not been ill is imperfectly educated. Pain is usually the prayer of the nerves for healthy blood. People learn it in very different ways. Sickly children are usually spoiled by indulgence. The worse the weather the better the exercise out of doors. Girls should be trained just like boys till adolescence; some even learn to box. Camp life for women with swimming, shooting, climbing, fishing, etc., are recommended.

The sudden insanity of Guy de Maupassant may well raise the question of the legitimacy of the aims of a school of art that seeks to reproduce sensation as its highest aim. If a man of great sensitiveness cultivate it with drugs and excesses, or would go about without his skin, or look straight into the sun, he is not a Promethean martyr to art, but simply lacks physiological common sense. The persistent dwelling, too, on things not of highest significance must also tend to upset the mind. Heine, Baudelaire, Byron, Musset, Jules de Goncourt and the

long list of gifted men who would not accept the ordinary limitation of mind in body have something clearly wrong about them. There is a wrong theory of art and of life.

Du Maurier's Peter Ibbetson is an autobiography of a man who during adolescence grew morbidly sensitive and bashful, though a man of handsome and imposing presence. He meets a beautiful dutchess, who later turns out to be an old playmate, dreams a striking dream about her, and finds she had dreamed at the same time the same dream of him. Hearing that the man he thought his uncle is his father he kills him and is imprisoned for life. For 25 years his dreams are filled with life with this beautiful lady. They were married, visited many scenes and lands. Everything, their dress, home, conversation were as natural as if real. At length he dreams she died (just as she did in reality do) and has an attack of suicidal mania, and is transferred to the mad-house. An interview with her spirit greets him and he dies as he finished his story.

Dr. S. Weir Mitchell, in his novel, *Far in the Forest*, describes several types of slight nervous ailment and a curious partnership between a blind and a deaf man, the former being a Swedenborgian dominated by auditory illusions. Paul Preston has the restless vivacity of slightly constructed characters, and like men of his type resembled certain immature feminine natures, and had a like attractiveness. He was easily pleased, and would go any length to escape pain, and a slight but painful malady bred a habit of resorting to opium, a habit most easily made and hardest to break. His moral energy gradually was lost, his property vanished, and even life in the backwoods could not save him. Shortly before death he characteristically lost his love of the drug.

TASTE AND SMELL.

PROFESSOR E. H. S. BAILEY, PH. D., University of Kansas.

LES ODEURS, *Demonstrations pratiques avec l'olfactometre et le pese-vapeur*, par M. Charles Henry, Paris, 1892.

In this valuable contribution to our knowledge of the odors, the properties of gases and vapors are discussed, more especially those points that refer to the tension of vapor and its expansion by heat. There are some inorganic bodies that possess an odor, but most of the perfumes are of organic origin. Various attempts have been made by Berthelot and others to classify odors, but the task is a difficult one. His classification is based upon the chemical composition of the organic bodies. The question naturally arises, is there any relation between chemical composition and odor? From some studies that have been made there seems to be a relation between the odor and the atomic weight. As the odor is in a great measure independent of the chemical composition, it must depend upon the molecular arrangement of the atoms and this seems to involve the discussion of isomeric bodies, and of the constitution of the more complex hydrocarbons.

There are six methods of extracting perfumes; expression, distillation, maceration, enfleurage, a pneumatic process, and finally, a process by solution in volatile liquids. From the various products thus obtained, the extracts, bouquets, pomades, etc., of commerce are obtained. Eugene Rimmel's table of classification of natural odors is of interest, and is the basis of specific description in regard to the sources of numerous perfumes.

It is supposed that perfumes are propagated by the emission of solid, liquid or gaseous particle, hence the laws of diffusion and of evaporation must be studied. But little is known of the diffusion

of solids, but the diffusion of liquids has been thoroughly studied. It is evident that the volatility of a liquid may be expressed by the weight of the liquid that evaporates per second from a square millimeter of surface, at a given temperature. This weight is proportional to the excess of the maximum tension of the vapor at that temperature over the tension that the vapor possesses in the air, and furthermore this weight varies in inverse ratio to the pressure of the air, there being a special factor for each liquid. On this account evaporation is of value in the determination of the purity of a liquid. The *pile-vapeur* described by the author is really a small hydrometer, floating in alcohol. At the upper end of this instrument is a cup into which the volatile liquid is poured. This cup slides up and down in front of a graduated scale. As the liquid evaporates, of course the instrument floats considerably higher after some time. Ether is taken as a standard of comparison. The laws that govern evaporation, when the surface is not exposed freely to evaporation, as when it is covered with some non-absorbing membrane, are of special interest and have been the subject of a series of experiments by the author and M. Gustave Robin. The instrument called an *olfactometer* gives what may be called the measure of the intensity of a perfume, as it is designed to determine the weight of the vapor that must be evaporated and must find its way into the nasal passages, before the operator can perceive the odor. Indeed, it is proposed to use it to estimate the comparative value of different perfumes.

The olfactometer consists of a glass cylinder supporting, by a cork in its upper end, two tubes sliding the one within the other, the outer tube being of paper and the inner of glass graduated in millimeters, and projecting above the apparatus, where it terminates in a forked tube carrying a glass stop-cock. The forked tube is introduced into the nostrils during the experiment, and a small quantity of any odorous substance is placed in the outer cylinder by a pipette, through the opening that is provided for that purpose. The operator then notes the time, inspires the air regularly, and slowly raises the tube. He notes the time when he first perceives the odor, which has penetrated through the paper, and reads the mark on the graduated tube.

By filling the tube with carbonic acid gas it is possible to determine the proportion of the volume of gas absorbed at each inspiration to the total volume of the tube. By means of a pneumograph it is possible to obtain a record of the inspirations and thus what may be called the coefficient of inspiration. The record is made upon the blackened surface of a paper attached to a cylinder, which slowly revolves. An interesting series of cuts is given to illustrate the effect of inspiration of different odors.

The gustatory organs of Belidens Ariel, Frederick Tuckerman, M. D.—*Journal of Anatomy and Physiology*, Vol. XXVI. p. 85.

The author describes in detail the circumvallate papilla, with the taste-bulbs, also the gustatory ridges and the fungiform papillæ. In regard to the gustatory ridges of this animal it may be noticed that there are structural characters common to both the circumvallate type of taste-area and the bulb-bearing ridges of *Ornithorhynchus*. The ridges of *Belidens* furnish an intermediate stage in the process of development of the former from the latter; the more recent from the more primitive type of the taste-area. Hence an important link in the history of this development is supplied, and now that two types are found together, it is possible that further investigation will reveal the foliate type in its simplest form co-existing with them.

A note upon the disturbance of the sense of taste after the amputation of the tongue, Frederick Peterson, M. D., Medical Record Vol. XXXVIII. p. 230.

There has always been great difficulty in tracing the course of the nerves of taste, and the distribution of the final taste filaments. It has been pretty well demonstrated that there are special areas of the tongue where certain tastes may be perceived and others that are susceptible to different tastes. The author has had an exceptional opportunity for making some experiments on the phenomena of taste, upon two patients whose tongues had been removed.

The first patient could, when liquids were given him to swallow, taste bitter, sweet and salt substances, but not acid substances. Special tests, made on definite localities, resulted in finding that bitterness was feebly perceived by the soft palate, strongly by the posterior wall of the pharynx, while sweetness was not perceived at all, except on the posterior wall of the pharynx. Saltiness was not perceived either by the palate or the pharynx, but probably by the surface of the epiglottis. The galvanic current, when applied to the parts, produced no sensation of taste.

Another noticeable fact was that the sense of smell was entirely abolished after the removal of the tongue, so that the patient could distinguish no odor whatever even in such strong smelling substances as tar, iodiform or oil of wintergreen. In the case of the second patient, whose tongue had been removed, besides the inability to distinguish acids, sweets could not be at all recognized.

The education of the sense of smell, Schneider.—Medical News, Vol. XXXVIII. 452.

Comparatively little has been done in making use of the sense of smell in diagnosis, for the reason that so far no one has been able to classify or describe the different odors. The author looks forward to the day when it will be possible to accumulate and transmit experience in the matter of smell as we now do in reference to the other senses.

Sur les minimums perceptibles de quelques odeurs, M. Jacques Passy.—Comptes rendus, Vol. CXIV. 306.

The experiments made are for the purpose of finding out the smallest amount of any specified odor that is perceptible in a liter of air. A set of standard solutions is prepared, each containing one hundredth as much of the substance as the previous one in the series. Then one drop of the last dilution is introduced into the liter flask, the bottom of which has been previously warmed, to render evaporation complete. After waiting long enough to allow the odor to diffuse itself through the flask, the experimenter smells of its contents and if he cannot distinguish the odor, he repeats the experiment with the next stronger solution, till it is just possible to distinguish the odor. When greater accuracy is demanded, several intermediate solutions may be made up between the last two solutions tested. This method has been proven to possess several advantages, not the least of which is the fact that the observer can make the tests under normal conditions. The alcohol employed should be absolutely pure or an error may be introduced.

The following results show the minimum quantity that is perceptible in a liter of air; the results being expressed in thousandths of a milligram :—

Subjects.	Ether.	Orange.	Romarin.	Wintergreen.	Menth.	Vanillin.
No. 1 E	27 0.5	0.05	0.05	0.005	0.0005	0.0004
No. 2 "	22 1.	0.05	0.55	0.005	0.01	0.0005
No. 3 "	32 1.	0.05	0.05	0.005	0.001	0.00007
No. " 42 1.		1 to 3	0.05	0.05	0.005	0.001
No. " 40 4.		1 to 3	0.8	0.4	0.01	0.005

The different stages of the experiment may be defined as 1, smelling nothing; 2d, smelling something that it is not possible to define, and 3, ability to name the odor correctly. The figures found agree quite closely with those determined by Valentin many years ago.

On the nerve supply of the sense of taste, John Ferguson, M. A., M. D.—*Medical News*, 1890 Vol. LVII. 395.

It is quite generally admitted that the lingual branch of the fifth nerve and the gustatory branches of the glossopharyngeal carry the nerve fibres of taste to the tongue and palate. Are these the real supply to the parts of taste, or do they simply carry nerve fibres of taste to the tongue and palate? The author has had an excellent opportunity to observe a case in which there was a total loss of taste on the left side of the tongue, even to the tip. An autopsy was made which proved that the nerve supply of taste for the top and anterior part of the sides of the tongue comes from the fifth nerve and enter the superior maxillary division of the same nerve. The course then must be from the superior maxillary nerve into the spheno-palatine ganglion, thence by the vidian through the vidian canal to the gangliform enlargement of the facial, along this to the chorda tympani, through the chorda tympani into the lingual, a branch of the inferior maxillary of the fifth.

The conclusion is also reached that the vidian is not a motor root passing from the facial to the spheno-palatine ganglion, but a sensory nerve of the special sense of taste from the spheno-palatine ganglion of the second division of the fifth nerve to the seventh or facial; also nerve fibres of taste for the back of the tongue, fauces and soft palate cannot be carried by the chorda tympani. Proof is also adduced that the root of the glossopharyngeal nerve does not contain any fibres of the special sense of taste.

The route then for the sense of taste, so far as the glossopharyngeal is concerned, would be from the root of the fifth through its third division to the otic ganglion, from this by the small petrosal to the ganglion of the seventh, thence to the tympanic plexus, again by the tympanic branch to the petrous ganglion of the glossopharyngeal and by this latter to the back of the tongue, fauces and palate.

In a criticism on the above article in the *Medical News*, Vol. LVII. p. 464, by Dr. Chas. L. Dana, he asserts that while the researches noticed seem to prove that loss of taste is due to a disease of the vidian nerve, they do not prove so conclusively that the glossopharyngeal nerve has no gustatory functions.

Sur la physiologie comparée de l'olfaction, M. Raphael Dubois.—*Comptes Rendus*, Vol. CXI. 66.

The olfactory organs of mollusks have been studied by numerous experimenters, but so far little has been learned of the mechanism of the organs or of their mode of acting. It is a fact that many odors excite the organ of smell of *Helix Pomatia*, a mollusk well adapted to experiments on the special senses. The large tentacles are more sensitive than other parts, while that of the small tentacles, though considerable, is notably less than that of the large ones. As far as the rest of the external covering of the mollusk is concerned, it is excited by only a few odoriferous substances. There is greater sensibility at the extremity of the large tentacles, though it is apparent throughout the

whole length. The experiments on snails were made by separating the tentacles and closing the end with a clamp, then these were put into a vessel containing moist air and it was noticed that after a time the movements of the tentacles ceased, but if some strong vapor, like that of benzine, was introduced into the vessel the movements would begin again with great activity. From these experiments and others in the same line, the author concludes that it is the sensibility of the segments that is first excited, then this sensation is transferred by contraction, which in its turn agitates mechanically the nerve terminals and is conveyed to the sensorial nerve centers. The first excitation is mechanical, just like that which produces the sensation of touch.

Further observations on the development of taste organs in man, Dr. Frederick Tuckerman.—*Journal of Anatomy and Physiology*, Vol. XXIV. p. 130.

In the tongue of the human embryo of the tenth week, the organs were so slightly developed as to be hardly worthy of notice, but in the examination of the tongue of the fœtus of the fourteenth week it was noticed that the upper surface was more or less marked by papillary elevations of the mucus membrane. The different layers of the epithelium were also studied. The striated muscle fibres were clearly to be seen, but the striæ were exceedingly faint. Some papillæ of the circumvallate type, in the early stages of development, were present, and the future position of the trachea was clearly indicated. Lateral gustatory organs could be perceived at the sides of the back of the tongue. But little could be learned of the structure of the bulbs in the circumvallate papillæ.

Ueber das Vorhandsein von Geschmacksempfindung im Kehlkopf, Dr. P. Michelson.—*Archiv für pathologische Anatomie und Physiologie und für klinische Medicin*. Vol. CXXIII. 389.

The author has studied the special functions of the taste cells of the inner portion of the trachea. He experimented on 25 persons, by putting into the throat upon the end of a bougie concentrated solutions of quinine and of saccharine. Seventeen persons were able to distinguish the bitter taste of the former, three thought it bitterish and the rest were in doubt as to the taste. With the saccharine solution all but three of the twenty-five could recognize the sweet taste. There was one special case in which the bitter could not be detected at all, while the sweet could be readily recognized. Some, in reply to a question as to the locality where the sensation was recognized, said it was where the solution was applied, others that it was in that region, while some simply located it deep in the throat. The electric current was also applied to the same localities, and it was noticed that the application of one pole produced the sensation of an acid taste and the other of an alkaline taste.

Sur la norme de l'acuité olfactive (olfactie), Zwaardemaker.—*Archives Néerlandaises*, XXV. 131.

From the average acuteness of the sense of smell accurately measured in 21 persons with the author's olfactometer, a norm is reached on which is based a system of measuring and recording the acuteness of smell, modeled after that in use by oculists for visual acuteness. The *olfactie* or average *minimum perceptible* of smell is the unit taken for these measurements. The average for a table of proper proportions of these substances and pictures of the olfactometer may be found in the original. When the mixed odors are delivered to the same nostril it might be supposed that they neutralized each other by some chemical

or physical change, but this is out of the question when each nostril receives a single odor, when the phenomenon is no less to be observed. By the adoption of porous earthenware cylinders in his olfactometer, Zwaardemaker is enabled to make tests with any odorous solution of definite dilution and most important of all to make them with chemical substances of known formulæ. It is to be hoped that the author will continue his studies in this interesting and, until his investigations and those of Aronsohn, rather unsuccessfully worked field. The 21 persons (furnishing 34 normal nostrils) is 1.5 degrees on the olfactometer (i. e., they could just perceive the odor furnished by the inside surface of a vulcanized rubber tube of 8 mms. bore when 1.5 cm. were exposed). The figure occurring most frequently, however, was 0.7 degrees; and Zwaardemaker's own *minimum* is 1.0. The figures for the cases examined, as also those for some visual tests made by the author, appear in the original.

Compensation von Gerüchen mittelst des Doppelriechmessers, Zwaardemaker.—Fortschritte der Medizin, 1889 Vol. VII. 721.

By use of his simple olfactometer the author has been enabled to verify, amplify and give numerical exactness to the empirical observation of perfumers, physicians and others that certain odors do not blend but neutralize each other. In this way the odor of vulcanized rubber may neutralize the odor of cedar wood, gum benzoin, paraffine wax, balsam tolu, and in turn be neutralized by any one of them if the odors are rightly graded in intensity; if the right proportion is not observed either one or the other prevails.

SPACE, TIME.

LIPPS, *Die Raumanschauung und die Augenbewegung*, Zeitschrift für Psych. u. Phys. der Sinnesorgane, 1892 III.

This is mainly a criticism of "eye-movement" theory, from the standpoint taken in other writings of the author. Lipps insists on the distinction between what is really seen and what is inferred, be the "seeing" normal or abnormal. Such optical illusions as the apparent inequality of distances and of line lengths are simply a result of our comparison—a matter of judgment. Eye-movements help us to form our space-consciousness by giving clearness and certainty to perception. Furthermore, if we regard the field of vision as a section of the larger space-world, which we survey by moving our eyes or turning our head, we may say that the position (and change of position) of the visual field is measured by such movements, without admitting that the relative position of points in that field is affected.

We do not *see* distance; we *judge* one object to be more or less remote than another. In this, as in other sense-perceptions, we *believe* that we perceive something, which in reality we do not perceive. The *form* of our visual field is likewise the outcome of judgment. The inference, not of our original, but of our developed space-consciousness, is based on eye-movements, and especially upon convergence-sensations. The original field of vision is no more a hollow sphere than it is a plane; in fact, for monocular vision there is no such thing as a spherical field. The "Blickpunkt," which is supposed to sweep round in immense circles, is an abstraction. The points successively fixated range themselves in circles because of the dome-shape of the visual field—a shape given it by experience, inasmuch as we perceive no difference in those sensations of convergence, which have come to be distance signs, and therefore regard the objects to which they correspond as equally distant from us.

The consciousness that objects are at *different* distances from us tends to correct our perception of their size. Hence, a conflict between per-

ception and the after-estimate. If the claim of the former could not be repressed, our field of vision would really be spherical; as it is, the fiction of such a form is harmless, provided it be not mistaken for reality. The probability of completely setting aside the evidence of perception decreases when the contrast between it and the correction urged by experience is too broad, or when the motives for such correction are not forcible enough. In the latter case, the convergence-sensations are not definite, or are not closely connected with the consciousness of size and distance. The influence of these conditions suffices to explain certain optical illusions without bringing in the eye-movement theory. To our indirect vision, a slanting line seems vertical, because our indefinite consciousness of its position does not force us to correct the perception, i. e., to lengthen in thought the distance of its farther end. The apparent curvature of straight lines is easily understood when we remember that straightness is not given in perception, but is a subjective product, and that the distance-relations out of which it grows are liable to vary with the changing effect of convergence-sensations. When these sensations correspond to the main point of regard, the curvature is less marked, because they indicate with special clearness the position and distance of the points in the line. When they have been trained by experience, as in the case of short distances, they yield an immediate impression of true distance and real magnitude; but when such experience is lacking, as it must be for greater distances and very acute angles, their worth, as distance signs, is merely analogical.

If we fixate the middle-point of a straight line, without regard to any point outside, the contradiction between perception and reality is less striking; the naturally favored straightness asserts itself; there is scarce an appearance of curvature. The illusion is more striking when we view the line with reference to a point outside, because the contradiction is greater. Observation of lines that seem to bear towards the eye, concavely or convexly, shows that the chief point of regard and our "spatial middle-point" may coincide, but not that they necessarily do so. Our consciousness of curvature is therefore variable, and is conditioned, not by the laws of eye-movement, but by our own mode of apprehension. The same holds good of our space-estimate and its results. The ground seems to rise towards the horizon, not because we raise our eyes, but because we underrate the distance of remotest points. The right eye undermeasures a line on the left, and vice-versa, because owing to the acuteness of the angle, we undervalue the distance differences between the line and the remoter eye. In binocular vision, the nearer eye guides our estimate according to the principle of "habitual average valuation," and the judgment thus formed affects monocular vision. The same principle accounts for errors in measuring vertical distances, and for the over-estimate of horizontal distances on the left as compared with those on the right.

E. PACE.

DE MEMME, *L'ipotesi degli spazi a n dimensioni in rapporto con la psicologia e la gnoseologia*, Riv. di filos. scient. 1891 (2) X. 688.

On the principle that geometry of n dimensions is merely algebra written in metaphor, De Memme criticises the hypothesis of Helmholtz and its application, by De Saussure, to physical and chemical problems.

FALK, *Versuche über die Raumschätzung mit Hülfe von Armenkneigungen*. Inaug. Diss., Dorpat, 1890, p. 58.

Falk studied the absolute and relative error in judging space distances by a movement of the forearm. The forearm was supported from elbow to finger-tip in a convenient carriage moving along a slide; this carriage

could be stopped at either end at desired points so that the distance moved over could be conveniently and accurately read off. By aid of certain appliances the apparatus was serviceable for the methods of right and wrong cases and of the average error. There was also used a combination of the method of right and wrong cases, and of the just observable difference, which has nothing in its favor and its complexity against it. At other points the author is too much dominated by methods hardly applicable to the variable character of his results. The movements varied from 1 to 20 cm., and were made with the shoulder joint as a pivot, moving through an angle of from about 2° to 40° . Falk studied the effect of the rate of movement and the weighting of the carriage upon the constant and the variable errors. The attempt to reproduce distances of 1 cm. resulted in an exaggeration of 81% of 25 cm., 33% of 5 cm., 12.4% of 10 cm., an underestimation of 0.45% and of 20 cm., 0.82%. The movements forward or away from the body are somewhat more accurate than movements backward or toward the body. Weighting the carriage with from 100 to 600 grms. does not appreciably affect the constant error. Passing to the variable error the measure of sensibility is not constant; when expressed by $\frac{1}{x}$ for 1 cm., it is $\frac{1}{x}$ for 2.5 cm., $\frac{1}{x}$ for 5 cm., $\frac{1}{x}$ for 10 cm., and $\frac{1}{x}$ for 20 cm.; the smaller movements showing the least sensibility. Movements forward show rather finer sensibility than movements backward. The rate of movement has only a slight effect upon the percentage of right judgments, that of 6 per minute having a slight advantage. The effect of weighting the carriage is also insignificant. Weber's law does not hold within the distances measured. The curve of movement as recorded on a drum and shown to gain slowly, reach a period of constancy and maximum rate, and again fall off.

BONNIER, *Physiologie du nerf de l'espace*, Comptes rend. 1891 CXIII. 566.

An acoustic disturbance coming from a given direction arrives at the ear under a certain angle of incidence, is reflected by the concha and the walls of the meatus externus and reaches the tympanum under a new angle of incidence which for a given end depends on the original angle. The concave and conical tympanum is driven back in the axis of its cone, if the noise arrives in that direction, and oscillates sidewise if the sound arrives in an oblique direction, drawing after it the point of the hammer. The system of the anvil and hammer forms a bent lever suspended on an axis that, thanks to the articulation of the joint, itself bends in the form of an elbow, and can turn in any direction. On both sides of this articulation there are three pivots, two for the hammer and one for the anvil. The external process of the hammer serves as pivot for the lateral downward oscillations of the hammer and as axis for the backward oscillations. The short process serves, above all, as axis for the movements from without inward, and as pivot for oscillations in any direction. The superior posterior process of the anvil serves as its pivot for all movements of bending in the central articulation and as axis for the direct oscillatory movements of the entire system. The articulation permits motion in every direction while yet retaining the total oscillation from without inward. According to the lateral oscillation of the point of the hammer, the system bends so that the surfaces of articulation quit each other at some points to meet at others, in such a manner that the angle formed by the two free arms varies in planes equally variable. The point of the anvil transmits by a double articulation its oscillations to the head of the stirrup, which in its turn oscillates around its tendinous insertion, pushing the base of the fenestra ovalis according to its various inclinations, which are the reverse of those of the point of the anvil, but always without disturbing the backward compression. According to its obliquity the plate of the stirrup

in forcing itself into the opening tends to depress such or such a pole of the adjacent utricular convexity. According to this compression, and according to the pole depressed, a circulation of the endolymph is caused in the utricle. This provokes corresponding currents in the semi-circular canals. These compensating currents vary in direction and intensity, depending on the direction of the displacement in the utricle, the pole depressed and the direction of incidence of the disturbance. The cristæ of the ampullæ perceive on opposite sides the direction and the intensity of these currents, which reconstitute in a manner the geometric description of the utricular disturbance. The nerve of the flat macula perceives the intensity of the disturbance which arrives diametrically from the convex wall, while the three nerves of the ampullæ analyze its direction. The so-called nerve of space is then only the nerve of disturbed space and of sonorous space. It defines the position of the points perceptible by the ear by means of the disturbance of the interposed medium. It localizes objectively the origin of auricular perceptions by the direction of the incidence of the disturbances.

E. W. SCRIPTURE.

SCHUMANN, *Ueber die Unterschiedsempfindlichkeit für kleine Zeitgrößen*, Zeitschrift für Psychologie und Physiologie der Sinnesorgane, 1891 II. 294.

The experiments were performed by the methods of right and wrong cases and the average errors. The clicks which gave the time interval were produced by the momentary passage of a current in a telephone. The closing of the current was done by contact with platinum points on a regularly revolving wheel. Time intervals from 0.15 sec. to 2 sec. were experimented upon by the method of right and wrong cases. The discriminative sensibility was found to be greatest for 0.3 to 0.4 of a second, a result in agreement with that of Mach. By the method of average errors experiments were tried upon intervals from 0.5 to 5 sec. This method, however, cannot be employed for solving this problem, because the average error is very great with intervals between 0.3 and 0.4 seconds, whereas, the discriminative sensibility was found to be finest at this point by the method of right and wrong cases. Moreover, comparison and reproduction of small time intervals are different operations.

BERGSTRÖM.

EPSTEIN, *Die logischen Principien der Zeitmessung*, Leipzig, 1887.

The author reviews the opinions of Newton, Locke and Leibnitz; and at the end of his article some of the recent mathematical definitions of equal times. He approaches the problem from the side of the theory of knowledge. Time is an auxiliary variable introduced by us into the phenomenal world to give order to its events or processes. Equal times are those in which identical events take place. But we have no criterion of identical events and must content ourselves with considering those events identical for which the contrary hypothesis would be less reasonable.

BERGSTRÖM.

METTLER, *Aural vertigo (Mentière's Disease)*. Journ. Nerv. Ment. Dis. 1891 XVI. 19.

There is no sufficient reason for supposing that the semi-circular canals or any other definite organs are the seat of the sense of equilibrium. The feeling of equilibrium is due to the harmonious relations of the sensory centers to each other and to the motor centers connected with them. Any serious injury to the centers may bring about the mental confusion and motor ataxy which we call vertigo.

BERGSTRÖM.

G. MOURET, *Le Problème d'Achille*. Revue Phil. Jan. 1892.

According to Mouret, Zeno is guilty of a "*petitio principii*," because he seeks an unknown quantity which his very method excludes. The error permitted in dealing with convergent series should have been rectified by passing on to the limit, which in this case is zero, and consequently implies a position common to the tortoise and his pursuer. This correction once made, it is clearly possible for Achilles to overtake the tortoise; whether he actually does so is a question that depends not on the relative, but on the absolute, velocities. If these do not approach zero, Achilles will succeed within a determined time; if they do approach zero, he will never succeed, but his failure implies nothing at variance with the concept of motion.

EPSTEIN, *Die logischen Principien der Zeitmessung*. Inaug. Diss., Leipzig, 1887.

On the side of empiricism, Newton distinguished between absolute and relative time. The absolute or mathematical time has a uniform flow; the relative time, measured by cosmic or artificial motion, is subject to irregularities because the motions vary. Absolute time, like absolute space, matter, and motion, are not abstractions needing justification, but the vera causa of the corresponding relative facts. None of our measurements correspond to the actual or absolute qualities. The error takes different directions for time and space. We cannot perceive empty space, only space as occupied by bodies. If these were at rest, space could be mapped out with accuracy; but since they are probably in constant motion, the point from which we measure is liable to change. Motion is the only measure of duration; if it were uniform, it would measure absolute time; but no uniform motion is known, so in the case of time our unit of measure is liable to variations.

On the psychological side Locke came to a similar conclusion. A notion of time is gained from the succession of ideas. From periodic sensations we derive a unit of measure, which we extend to all phenomena in which such a unit is absent. Not simply motion, but all periodic phenomena furnish a unit of time. The difficulty with time measurements is that we know no uniform motion or regular periodic process. The year, the day, the swings of the pendulum—all vary. A second difficulty peculiar to time is that one stretch of time cannot be superposed upon another, while this method of superposition is the foundation of space measurement. The author shows that this class of objections, though of special force in regard to time measurement, applies to the measurement of any two different parts of the same continuum, whether time, space or motion.

To apply geometry practically we pass from the absolute to the relative space by two axioms, which may be united as follows: A body under the same conditions, at different places, or at different times, occupies equal spaces. Practical time measurement is founded on a similar axiom. An event under the same conditions at different times or at different places has the same duration. The empirical and naive psychological theorists considered time a substantial thing whose nature was to be investigated, and found discrepancies between the absolute and relative or practical time measurements. The author treats the problem from the point of view of the theory of knowledge. Time is not to be considered a substance, but as a category introduced by us into the phenomenal world to give order to events. The phenomenal world is united into a whole by the causal category; any given value of it determines the next. Time is an independent auxiliary variable introduced to fix any given stage or value of this phenomenal world, and to enable us to pass connectedly from one value to another. It is the

means of a systematic view of natural processes. The question what is time, or what are equal times, is a matter of definition. Equal times are those in which identical events take place. Time is concerned only with events, and we know nothing of empty time. There is no criterion of identical events independent of time, and we must be content with assuming that two events are identical when it is more reasonable to assume that than the contrary. The paper closes with a criticism of the recent mathematico-physical definitions of equal times.

TOUCH, PAIN, INTERNAL SENSATIONS.

GOLDSCHIEDER. *Ueber die Summation von Hautreizen*, Dubois-Reymond's Archiv 1891, 164.

Lightly stimulate the skin with the point of a pin, or even a somewhat blunter instrument. A pricking sensation arises, dies away, and is succeeded by a secondary, or after-sensation, which also has the prickly feeling, but lacks the touch-tone which marked the primary one. It seems very much more as if it came from within. If the stimulus be stronger, but at the same time not quite strong enough to make the primary sensation painful, the secondary sensation will be felt as painful. But if the strength of the stimulus be still further increased so as to give the painful tone to the primary sensation, then the secondary is feebler than the primary, and does not flash out as clearly, since the interval between the two is partly filled by the persistence of the primary sensation. Goldscheider found that a single electric shock in no case gave rise to this secondary sensation. In order that it should arise it was necessary to make a number of such stimuli, one after another, on the same spot. This gave a clue to the explanation of the above phenomenon, and also suggested lines of experiment. He and Herr Gud sought to determine under what conditions a series of stimuli is competent to produce the secondary sensation,—how long the series must last, what the interval should be between the shocks, and what the intensity of the current. A series of four gives a clear secondary sensation, but only with certain intervals between the stimuli. With an interval of from 0.03 to 0.06 second, the sensation is most clear. As the interval is made smaller than the former number, or larger than the latter, the secondary sensation becomes less and less clear, finally disappearing altogether. The like is true if the number of stimuli in the series be increased. For each number a certain range of interval is found which gives the secondary sensation the maximum of distinctness. This interval varies, however, inversely with the number of the stimuli. The product of number by interval is found to be (nearly) constant.

In each case a certain intensity is found best fitted to give the secondary sensation. Increasing or diminishing the intensity beyond this point enfeebles the effect. The time elapsing from the end of the series to the rise of the secondary sensation was measured and found to be (on the hand) about $\frac{1}{10}$ second. Increasing the duration of the series by increasing either the number of stimuli or the interval between them has no appreciable effect on this time, until the point is reached when the number of stimuli given is just the number necessary (with each particular interval) to bring out clearly the secondary sensation. If we increase the number beyond this point, the secondary sensation comes out independently of the duration of the series, but with its same time-interval. That is, increasing the duration of the series beyond this point, the interval between the end of the series and the rise of the secondary sensation is correspondingly shortened. When the series is made to last about $\frac{1}{10}$ sec., the secondary sensation flows into the primary, or does not arise at all. Similar results are found with

mechanical stimulation. The reaction time is in effect the same, provided the intensity and duration are made as nearly as possible the same as with the electrical stimulation. Increasing the duration of the stimulation up to a certain point has no appreciable effect on the interval between the *end* of the stimulation and the rise of the secondary sensation. But when a certain point has been reached, then further increase in the duration has just the opposite effect. The interval from the *beginning* of the stimulation to the rise of the secondary sensation remains constant, while the interval measured from the *end* of the stimulation diminishes. The explanation, here, is the same as in the case of electrical stimulation; when the total stimulation has reached the intensity necessary to awaken the secondary sensation, a further increase of the stimulation has no effect on the time. The time required for the rise of the secondary sensation was found to be on the wrist shorter, and on the sole of the foot about half a second longer, than the time given above.

The secondary, or after-sensation, is a "summation-phenomenon." A mechanical stimulation, since it is competent to produce this secondary sensation, should never be regarded as a single stimulus, but always as a series of stimuli. Where this summation takes place it is impossible to say with certainty, but Goldscheider argues that it most probably takes place in the cellular elements scattered throughout the nerve tract. Each stimulus takes two paths; one goes directly to the centre of consciousness, the other is impeded on its way by the cellular elements and only succeeds in making its way on to the centre under certain conditions. The cells "store" the energy, and a series of stimuli is needed to make the stored energy amount to enough to express itself in action. When this does happen, however, these cells send also their message to the centre, but by a different path, which we may appropriately call the "summation-path." This summation-path, via the gray matter of the spinal cord, is the same as has been called the "pain-path." A single stimulus, if of exorbitant intensity, may be sufficient to break its way through this pain-path. When this is the case, we may have both the primary and the secondary sensations coming over the same path; in the original experiment, when we made the stimulus strong enough to give the pain tone to the primary sensation, we still had the secondary or summation-phenomenon, though, in this case, weaker than the primary.

CHAS. M. BAKEWELL.

Harvard.

SERGI, *Su alcuni caratteri del senso tattile, Osservazioni sperimentali.* Rivista di filosofia scientifica, 1891 X. 590.

A series of electric forks of 50, 100, 250, 435, 500 and 1000 v. was employed, a rigid and obtuse point of brass being substituted for the long fine point used for writing on the drum. The point was applied to some point of the skin to test the limit of rapidity of the blows given by the point that could be perceived as separate. The fleshy part of the fingers could perceive the stimulus as a succession of blows up to 1000 per sec.; many other parts of the hand, the point of the tongue and the red parts of the lips perceived 500, the greater part of the skin perceived 435 per sec. as a succession, which increased in clearness down to 50 v. The question of the intensity of the excitation and the special sensitiveness of the organ stimulated are then taken up. The final results of the experiments can be summarized as follows: 1. The cutaneous surface is not everywhere equally sensitive to tactile stimuli of small intensity; the most sensitive parts are always the palmar extremities of the fingers. 2. Many parts of the skin, although giving a definite sensation of touch, do not give it in the same clear and distinct

way as the digital extremities of the hand. 3. The minimum energy of stimulation, or the least perceptible stimulus, is variable according to the different points of the surface of the skin; in the successive stimulations at equal intervals, as with the tuning-fork, the only sensation which results is not produced by the fusion of the impressions through their persistence, as Bloch would have us believe, but through the insensibility to weak stimuli; that is why the stimulating point is felt as being firm if it is in immediate contact with the skin. 4. In tactile sensations properly so-called, that is, those of the skin, it seems that there is no persistence of the impressions, when the stimuli are limited to and produced by an obtuse point. This does not say that there is an accumulation of small impressions to produce a single result, as usually happens for some other senses and for electrical cutaneous stimulation (Richet). These phenomena on the contrary occur when there is a transformation of tactile impressions into sensations of pressure, i. e., when we cause an obtuse point to penetrate into the surface of the skin by pressure, and when there is a powerful stimulus with a large surface of special character. 5. It appears also that there is not any primary action, or period of latency, in the tactile sensations by which the sensation is developed in a shorter or a longer time, as happens in the case of the retina; it seems that excitation of a purely mechanical nature produces its effects immediately, and if it does not produce them at the first moment, then there is no perceptible effect; one can explain in the same manner also the lack of persistence, in addition to action of a weak stimulus, by the absence of the time of latency in the terminal organs of touch. If there be a primary action it must be of a duration absolutely incalculable, since a series of sensations with an interval of 1-1000 sec. can be perceived. 6. On the mucous membrane of the glans penis there is no sensation of a tactile character such as is found in the skin.

E. W. SCRIPTURE.

SERGI, *Ueber einige Eigenthümlichkeiten des Tastsinns*, Zt. f. Psychologie u. Physiol. Sinn. 1892, III. 175.

An unacknowledged translation of preceding.

E. W. S.

BUYS, *Recherches expérimentales sur la sensibilité de l'ovaire*, Archiv. Ital. de Biol. 1891 I.

Chaignot had found that, in very many cases, during the later weeks of pregnancy touch upon the abdomen resulted in temporary, but clearly localized, pain of a peculiar kind. As exceptions were not wanting, it was left to decide whether the painful cases were due to disease of the ovary or simply to the greater sensitiveness of the individual. By means of an incision from behind, Buys contrived to apply an induction current to the ovaries of six dogs, and also to use direct mechanical stimulation. Strong irritation of the ovary produces intense pain, dilation of the pupil, increase of blood pressure through vascular constriction and slowing of the pulse through increase of the tonus of the pneumogastric. We are thus led to believe that numerous morbid alterations of these organs in certain circumstances influence circulation by affecting the vaso-motor centers. Thus may be explained, through ovarian irritation, disorders of local circulation so common during the menstrual period of life, or at the close of it.

Harvard.

J. F. ANGELL.

BITOT ET SABRAZÈS, *L'analgésie et l'atrophie des testicules dans l'ataxie locomotrice progressive*, Rev. de med. 1891.

This is a critical account of a number of cases of locomotor ataxia, from which conclusion is reached that analgesia of the testicles is so

frequent—though not invariable—under these conditions as to point strongly to a causal connection. This is indicated by the number of cases in which the analgesia appears at the inception of motor-inco-ordination.

Harvard.

J. R. ANGELL.

H. NOTHNAGEL, *Schmerzhaftes Empfindungen bei Herzerkrankungen*, Zeit. f. Klinische Medizin, 1891, ss. 209.

This article is mainly of value to the physician who would use the painful sensations in the cardial regions for the purpose of diagnosing heart affections in cases where the ordinary physical examination fails to reveal the cause of the trouble, and where, at the same time, there seems to be no functional nervous disorder which would account for these sensations by referring them to a "subjective" origin. Dr. Nothnagel concludes that the muscles of the heart are less concerned in the production of these sensations than the general circulatory system, but thinks that, further than this, it is impossible to reach any precise and satisfactory conclusions, owing to the complicated nature of the cardial nervous system. The cutaneous hyperalgesia and neuralgia found in some cases, he refers to as eccentric spreadings from the main seat of the disease such as we often find in diseases of the vital organs.

MISCELLANEOUS.

CORRE, *Crime et Suicide*, Paris, 1891.

After having in another work studied the criminal from the natural-history and medical point of view, the author proposes now to examine the genetic conditions of antisocial impulsiveness. The book consists in a general etiology of crime completed by a parallel etiology of suicide. As crime varies according to time and place, it is not definable from the act, nor from an antithesis to morality, which is everywhere conventional. The variability of sentiments is precisely the cause of the different interpretations given to correlative or derived actions. The opinion of the majority creates morality and laws. Natural crime is a conventional offense to the average opinion of each collectively. The characteristic of criminals resides in non-conformance to the social obligation of the moment. Man possesses just enough free will to regulate the modes of his collective relations under the form of a contract of necessity. There is no more responsibility in the absolute sense of the word than there is absolute liberty. Under the influence of alcoholism and of social perturbations, crime and insanity present a parallel evolution; the same causes which prepare or determine one affect the other. These diverse forms of aberrant or antisocial impulsiveness spring from the same solicitations. As one observes collective crimes under imitation and suggestion by example (crowds), so he also discovers collective insanity or demoniacal epidemics. It is true that degeneracy of all forms furnishes a large proportion of criminals; yet there is a sufficiently frequent manifestation of impulsivity in individuals of feeble mind or feeble moral resistance. The criminal is not a retrogression, but he is incomplete in evolution. The author does not admit a criminal type in the anthropological sense, but there are criminal types in the psychological sense; one, which comprehends the majority of criminals and includes a part of the criminals by occasion, is latent. The passionate type comprises those who are not degraded, but who are suddenly surprised by a criminal solicitation in a moment of exceptional need. There is another type including subjects of an unstable character, in whom reflection, after the first omission, is not sufficient to hinder a second fault; they are without hereditary taint, their criminality is acquired. A third type consists of those

degenerated through vicious habits, led astray by prostitution, debauched by temperament or by satiety of pleasure, the alcoholics, the morphimaniacs, etc.; under the influence of a special habit a criminal habit is born and developed. The fourth and last type is hereditary, sometimes susceptible of being referred to atavism, not of an ethnic type, but rather pathological, degenerative or teratological.

The suppression of a unity, or its reduction by lessening its conditions of resistance is a crime, from the social point of view. But is it a crime when it is the suppression of one's own proper person, or suicide? To prefer to die, rather than live in a slow degradation under the chains of misery, does not merit reproach but pity, and in some cases admiration. The suicides are the discontented; they do not oppose their surroundings, they simply abandon an environment which they believe themselves unable to inhabit. They do not differ much from those who, disgusted with the world, without knowing the world, at the age of virility, shut themselves in cloisters, protesting thus against the form of general society. Crime and suicide are two acts equally prejudicial to collective interests. They represent two modes of antisocial impulsiveness, which cannot be regarded as equivalents, although they arise from similar psychical aberrations and from conditions more or less analogous. Suicide has more alliance with insanity than crime has. Degenerative habits, as alcoholism, morphomania and debauch are the most intensive causes of attacks against others and against one's self. Alcoholism conducts men to suicide or to crime, according to their characters.

Washington, D. C.

ARTHUR MACDONALD

LYDSTON AND TALBOT, *Studies of criminals*.—Alienist and Neurologist, 1891, XIII. 556.

These deal with the "degeneracy of cranial and maxillary development in the criminal class," and are accompanied by illustrations of criminal skulls and histories typical of the physical degeneracy of the criminal. They are peculiarly valuable and interesting for comparison with the studies of Lombroso and other European criminologists. Talbot investigated a very large number of cases of habituals and murderers among the prisoners in the Joliet penitentiary. The histories and descriptions of these are given in detail, besides the results of examinations of the jaws and teeth of 477 criminal subjects (468 males, 9 females). Lydston presents also the results of his studies of the skulls of criminals and social outcasts of various nationalities and races.

The more pronounced criminal types are found amongst the imported criminals. Simplicity of gyres in the brain seems indicative of degeneracy. The most striking features of the criminal skull, as seen in American prisons, are the tendencies to brachycephalism and submicrocephalism and the great frequency of cranial asymmetry. The direction of the degeneracy is modified by racial characteristics. The dolichocephalic type, when degenerated, becomes in general more dolichocephalic. A striking feature of the degenerate skull, as illustrated by many skulls in the habitual criminal class, is its peculiar "twisted" conformation. Alcohol is the touch-stone, the crucial lymph, that brings out the inherent infection of madness, crime, or bestiality. Heredity is the latent power and alcohol the potential energy that drives the arrow to the mark. Left-handedness is rare amongst American and foreign-American criminals. One per cent. only of the 400 criminals in the Joliet penitentiary were found to be left-handed, and two per cent. in the New York city prison.

It is impossible to look over the descriptions of these criminals without noting the continual occurrence of facial and cranial asymmetries. The physical degeneracy and often the bad heredity of the subjects are

plainly shown, and their defective or degenerated mentality seems often as clearly indicated. With respect to the eyes of eighteen criminals, defective vision is recorded in five cases; in five cases one eye is perceptibly larger than the other, and other anomalies of development occur. Two cases of defective hearing are noted, and in no fewer than eight cases asymmetry of the ears prevails, besides other cases of auricular anomalies. The number of cases considered is obviously too small for general conclusions, but the facts cited seem in general harmony with the results of previous investigators.

The question of the asymmetry of the skeleton and of the bodily organs deserves to be studied more closely. From an examination of the jaws of 468 male criminals, Drs. Lydston and Talbot found that but 163 could be called normal, the rest departing from the normal type in one or more respects. Most of the deformities of the jaws and teeth were confined to the upper maxilla.

The craniological studies of Dr. Lydston seem to have covered a wide ground. In the skulls of these criminals and offenders against organized society, asymmetry and anomalies are equally as prominent as in the case of living delinquents. Some very interesting skulls have come into the possession or fallen under the observation of Dr. Lydston. Among these are the skull of the first Chinese suicide in America, a man who shot himself because the white girl to whom he was engaged proved false; the skull of a negro panel worker, the consort of a noted Chicago courtesan of other days; the skull of a notorious member of the *demi-monde* of Chicago, who was half Indian, half white; and the skull of a noted western desperado and train-wrecker. Upon the study of such material the authors have based their conclusions, which may be summed up in their own words: "As far as our observations go, they tend to show that a degenerate type of skull is common among criminals, and that the assertion of Lombroso, that the deviation of type, as far as the index is concerned is toward brachycephalism, is correct."

A. F. CHAMBERLAIN.

C. S. MINOT, *Senescence and Rejuvenation*, Journ. of Physiol. No. 2, 1891.

The fundamental properties of living organisms constitute the most fruitful theme of biology. From the age of Zero, or the moment of impregnation, animals and plants pass through a series of changes till, barring accident, they reach their limits of longevity. Rejuvenation is procreation. The author weighed, daily, hundreds of Guinea pigs. Gestation is shorter the larger the litter. There is a progressive love in the power of growth, beginning almost at birth, and suggests whether, in all animals, the impulse given at impregnation does not gradually die out. This is indicated by the author's very interesting curves. Curves at least is his theory of "physiologically equivalent weights."

DEMENY, *Analyse des mouvements de la parole par la chronophotographie*, Comptes rend. 1891. CXIII. 216.

M. Demeny gives an account of the application of the chronophotographic process, to the analysis of lip-movements in speaking; and of the construction of a zootrope, by means of which he succeeded in so synthesizing those movements that a deaf-mute, standing before the instruments, was able to read the phrase, whose corresponding lip-movements were thereby reproduced. Vowel and diphthong movements were interpreted as well as those of labials. The experiment was not a complete success; but this was due to the fact that part of the phrase pronounced was imperfectly photographed, and the deaf-mute was not quick enough to guess it from the general sense of the passage. Besides, the movements of the tongue were only very vaguely reproduced, and

consequently read with difficulty. The experiment is most successful upon deaf-mutes; since they are more accustomed by their peculiar condition to interpret mouth movements by sight alone than are normal individuals. Mr. Demeny expresses the hope that the zootrope, improved and perfected, may be of great value in their education.

F. TRACY.

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HENSEN, *Die Harmonie in den Vocalen*, Zt. f. Biol. 1891, XXVIII. 39.

HENSEN, *Nachtrag zu dem Aufsatz: Die Harmonie in den Vocalen*, Zt. f. Biol. 1891, XXVIII. 227.

The problem proposed is: why is this fundamental tone always absent in the case of vowels produced in singing? Hensen imitates the arrangement of the pharynx and the mouth by a reed-pipe in connection with a resonator. The pipe sounds only with a certain pressure of air. If the resonator is brought into connection with the pipe while the air-pressure is still too small to cause the pipe to sound, the tone of the resonator is heard; as soon, however, as the pressure is great enough for the pipe to sound, the resonator tone ceases. The experiment can be tried in another way. The resonator is held to the ear; its own tone ceases as soon as the pipe sounds. Brought into connection with a manometric flame, and made to vibrate by an appropriate tuning-fork, the resonator shows its tone; but as soon as the pipe is sounded the resonator does not respond unless both are arranged for the same tone. These experiments all seem to prove that a sounding column of air, such as that in the buccal cavity, is incapable of bringing out the tone of the cavity in which it is contained in addition to the tone impressed upon it. The latter part of the former article of Hensen's and the whole of the second one are occupied by a discussion with Hermann.

E. W. SCRIPTURE.

JASTROW, *The Natural History of Analogy*; Address before the Section of Anthropology, American Association for the Advancement of Science, at the Washington Meeting, August 1891. Salem, Mass., 1891, pp. 23.

Prof. Jastrow's address serves to show the close relationship which exists between anthropology and psychology and to emphasize the importance of studies in the field of psychical anthropology. "Deeper than the language of words and underlying their use and formation is the habit of comparing object with object, of tracing resemblances and noting contrasts. It would seem that in the savage's use of this process there is lacking the distinction between the resemblances inherent in the objects and those originating in the mode of viewing them; subject and object are still merged in a vaguer realm of thought, where myth and science, poetical fiction and evident fact mingle without let or hindrance." Prof. Jastrow proceeds to illustrate, by examples selected from all over the world, "the rôle that analogy plays in primitive circles, the essential influence it exerts over thoughts and customs in the early history of mankind." Witchery and sorcery, cannibalism, magic, astrology, dream-interpretation, name giving, etc., are shown to rest upon a general basis of analogy. Reasoning by analogy is next considered. Its use by children, in dream-interpretation, in astrology, in the doctrines of sympathy and of signatures, folk-medicine and the like is indicated. The general conclusions are: "Analogies which are but fancies to us were to men of past ages reality (Tylor)." The principle that what was once the serious occupation of men becomes in more advanced stages of culture the play of children, or is reduced from seriousness to mere amusement, finds illustrations in

the mental as in the material world. "The formidable and trusted argument by analogy finds its proper field in riddles and puns." "In such exercises of fancy we are employing the same faculties that our ancestors used in arriving at the customs and beliefs that we have been considering. The laws governing the progress of industrial arts, of mechanical inventions and social institutions seem thus to find equally ready application to the evolution of habits and customs in the mental world."

A. F. CHAMBERLAIN.

PILO MARIO, *Il piacere estetico eola Astiologia del bello*, Riv. di filos. scient. 1891 (2) X. 599, 667.

Pilo insists on the popular definition of the beautiful—that which pleases—and shows that other definitions, especially Mantegazza's, can be reduced to this. Genetically speaking, beauty begets beauty, whether the suggestion be of the present or of the past. The impression produced by the simultaneous action of various æsthetic forces is not their simple sum, but their resultant. Beauty, like goodness and truth, being relative, has no absolute standard. Ruled by the laws of *heredity*, the æsthetic sense varies according to pace, sex and age—now strong where the moral and intellectual faculties fail, now weak where these are marked. In the environment, culture, art and public taste are determining influences. Finally, the need of change brings about, by natural selection, new phases of art and of appreciation.

E. PACE.

Washington.

J. JAURÈS, *De la Réalité du Monde Sensible*, Paris, Alcan. 1891. p 370.

The reality of the external world is not a mere dispute of the schools because the mind had asked itself this question before there was a scholastic tradition, and before curiosity had been artificially refined. The book is a thesis for the doctorate at the Sorbonne. The author was known as a political orator, and his work is here marked by an elocution of style which caused P. Janet to compare it with a symphony. It adds little that is new, and its solution is substantially that of Thomas Aquinas.

ARRÊAT, *Psychologie du Peintre*, Paris, 1892 p. 264.

This is a series of etchings in ink such as one would like to read at Barbizon. The author's own words take up the least part of the book, for he allows the painters themselves to do the talking; and if we hear the same voice more than once, the repetition comes of the arrangement. In five parts, A. delineates the physique, the vocation, the mental qualities, the character and the pathology of the painter. The artist has a certain air about him by which he is easily recognized in a crowd; but to say just in what this consists, to single out a typical face, is not easy. Physiologically, there is no uniformity beyond a nervous excitability, which often leads to excess of various kinds. Nor is the painter's genius always inherited; for though, out of a list of three hundred, two thirds are descendants of painters or artificers, there still remains a considerable number whose ancestry had no artistic bent. But whatever its origin, the painter's vocation, with its peculiar æsthetic traits, asserts itself at an early age. It is shown, as a rule, in precocious children, quick to admire and keen to analyze the beauties outspread to the eye. Impressions thus received fasten on the imagination; the visual elements and the motor elements of memory unite; the hand is as true in reproducing as the mind in retaining. The particular elements, however, which are imaged and transferred to canvas depend

upon a previous analysis of the sight-presentation. In the infancy of art as in that of the individual, outline alone is regarded; then come relief and, finally, color.

This growth in the appreciation of visual impressions goes on, it would seem, at the expense of higher powers. With some rare exceptions, painters are intellectually poor. Lacking in general culture, in judgment, in the scientific grasp of the very principles which underlie their art, they more often possess a strong emotional memory and a consequent partiality for the kindred arts of music, architecture and poetry. Not that they are incapable of thinking and writing on matters of their own profession; the numerous extracts from their letters, which A. presents us, are much to their credit. But with all their powers of invention, they seldom appear to advantage in the field of literature. The brush is their pen. The message it bears to the world is tempered of course by the artist's personality. But he, in turn, feels the influence of his environment. Nationality and climate have a visible effect on inspiration. It is not nature alone that furnishes the theme. The pages of a Shakespeare and of a Byron, the facts of history, even political changes, have aroused the painter's genius. Religion, especially, in its various forms, has been a fruitful source of inspiration. From Raphael to Baudry, from Michael Angelo to Millet, it is the religious element that dominates.

Under all these influences, the painter's individuality must not be forgotten. His character, as pictured by A., is not without its shadows. Comparatively few artists have been tainted with the lowest sort of egotism—the greed of gain; nearly all have felt the thirst for fame, and this, though it check more sordid impulse, rarely suppresses the promptings of vanity and jealousy. Such vices, however, do not dry up all sympathy, nor deaden the sense of duty to parents and family. The painter's first love is his art; to other loves he is neither more faithful nor more faithless than the rest of men. The recklessness of some contrasts with the steady attachment of others, and the bitterness of rivalry, is offset by many an instance of tender friendship between master and pupil, or between comrades of the palette. It is, too, this devotion to his art that explains the painter's indifference in matters political or even patriotic: he is at home wherever genius has left its trace. Such being the artist's character, it remains to be seen with what degree of energy he responds, when his egotism or his sympathy is aroused. Most painters are ready to make any sacrifice, to undergo any privation, that will help them to a higher niche; and this certainly means strength of will. But in point of sustained effort, such as perfect execution requires, they offer broad contrasts. There are those who go at their work calmly, patiently, tolling steadily from the first trace to the final touch—models of concentrated attention. These are the masters. Others are exhausted after the first *élan*; the sketch absorbs their warmth; the after-work finds them cold. Parallel with this difference of energy go the differing habits of life. According as we study one or the other of these classes, we see in the atelier a pattern of neatness—or a den; in the artist, precision of method and correctness in personal appearance, —or the negligent slouchy ways of a man habitually *détraît*.

Doubtless these qualities, attractive or repulsive as the case may be, go far in determining the painter's social position. But aside from individual traits, his standing in the world results from a peculiar combination of facts. His work is the work of genius, creative, ideal, and yet it must bring him his bread. The consciousness of his own worth, which never deserts him, sets him at ease with patrons who appreciate his merit, be their station what it may; but it embitters him against those who value his work at market-price, and deal with him as they would with any producer. The mercantile side of life is hard enough

for the painter; harder still the lot of those who starve in despair of the reward which they have earned but not received.

At times, misfortune touches the artist more closely; he must struggle with defects of the sense by which he lives. Some have corrected the errors to which faults of the eye exposed them; others have been misled. More serious disorders, upsetting the mental balance and ending in suicide, are not rare among painters. Even in its normal phases, genius is eccentric; but we are not, for that reason, to infer that the creative faculty is a symptom of insanity. What is exceptional in genius is the union of many happy gifts; it is the attribute of those whose works, be that what it may, "touch human chords whose vibrations are deepest."

The psychologist, after reading this volume, feels like one who has been looking through a lattice. The glimpses he catches make him regret that the view is not more continuous, that there is no central thought binding all these suggestions together. M. Arréat, as the preface declares, is far from pretending that his work is perfect. He is searching for facts, and his search has been fruitful. But when sufficient material shall have been collected, it will certainly be an interesting task to single out the traits peculiar to genius, to analyze them and reduce them, in accordance with psychological law, to their simplest elements.

PEREZ, *La maladie du pessimisme*, Rev. philosophique, 1892, XXXIII. 36.

This is a review and critique of two recent works, one by Magalhaes, *O pessimismo no ponto de vista da psychologia morbida*, and the other by Huyghe, *Des rapports de l'arthritisme avec les manifestations nerveuses*. The author advocates a psychology of diseases—a science that would connect with each morbid condition or disease its corresponding psychic manifestation. Educators would be able to diagnose the mind from the physical condition, and physicians to diagnose the body from the mental condition. A disease would have two indices instead of one. The two above-mentioned essays attempt directly, the other indirectly, to discover the pathologic condition that finds mental expression in pessimism. The one describes it as *neurosthenic affective*, the other as *arthritisme*.

Magalhaes' conclusions are based upon the study of avowed pessimists such as Leopardi, Schopenhauer, Flaubert, Baudelaire, Amiel and Byron, and of others who, without the creed of pessimism, reveal its characteristics. Among these are Carlyle, Swift, Tolstoi, de Sévancour, Shelley, and Chateaubriand.

Pessimism is regarded as a species of nerve weakness of which the chief character is nervous instability with alternation of irritability and prostration. The subject is super-sensitive; impressions call forth intense and prolonged reactions followed by exhaustion. He is characterized by a general hyperæsthesia, which naturally results in an excess of suffering. From instability and hyperæsthesia results discord between the feelings themselves,—between the feelings and the intelligence,—between the feelings, the ideas and the volitions.

The discord between the feelings shows itself in a great variety of paradoxes, contradictions and inconsistencies. To the pessimist the possession of a desired object does not atone for the former privation. The pain of unsatisfied desire is replaced by the pain of *ennui*. With inability to enjoy what he has are coupled extravagant expectations regarding that which he does not have. He is extremely susceptible, both to kindness and to contempt. He passes suddenly from violent irritability to languor, from self confidence and vanity to extreme self abasement.

His hyperæsthesia results in intellectual discords. For this involves a great vivacity of the intuitive imagination, which favors the setting

up of extravagant ideals lacking in solid representative elements. Hence a gap opens between his ideal and the actual. He can never realize the ideal he pursues and so his feelings take on a somber hue. From this excessive idealism results a mania of doubt (Amiel), a certain distrust of all his rational objective knowledge. It assumes another form in extreme subjectivism. The pessimist is haunted by images of tiniest religious scruples, suspicions, fears and anxieties, resulting in alienation from friends, seclusion misanthropy.

The pessimist is further characterized by an incapacity for prolonged attention, a refractory attention and a feeble will. These result in inaction, quietism, reverie, self-objectivation, abolition of the personality, annihilation of the will, mounting sometime even to poetic or religious ecstasy.

More than Magalhaes is Dr. Huyghe concerned with the pathologic basis of pessimism. He connects it with arthritism, a constitutional disturbance of nutrition and circulation, resulting in local congestions of vitiated blood. These may result in gout, rheumatism, kidney or brain diseases. Is there any psychic aspect to these maladies? The ailments associated with hypochondria or melancholia with all of them. Pessimism would seem to be the mental side of arthritism.

These essays do not ignore the existence of an impersonal, intellectual, objective pessimism, having a basis very different from that of the personal, sentimental subjective pessimism. Connecting the latter with neurosthenia or arthritism leaves the philosophic question just where it was.

E. A. Ross.

Univ. of Indiana.

GRÉHANT, *Sur un nouvel appareil destiné à mesurer la puissance musculaire*, Comptes rend. 1891, CXIII. 212.

M. Gréhan describes his dynamometric myograph (a modification of Prof. Marey's spring myograph) for registering and estimating muscular effort. A steel spring, 400^{mm} x 18^{mm} x 2^{mm}, is fastened at one end firmly to a table, and to the other is attached an adjustable self-feeding pen, which traces, upon a revolving paper cylinder, a line of abscissa and a curve. A cord, having a wooden handle at one end, is attached to the spring at the other end. The person sits before the instrument, with his arm supported in such a position that the elbow forms a right angle, and the hand grasps the handle. By a violent jerk the forearm is bent upon the arm, and the style traces a denticulated curve. Now to measure the muscular power, it is only necessary to pass the cord over a pulley, and attach weights, until the pen traces a tangent to the summit of the curve. In several experiments M. Gréhan found the muscular power of the biceps and of the brachial anterior to be from 15 to 45^{kg}. He adds that multiplied experiments would, doubtless, yield a wider range of results.

F. TRACY.

In connection with the department of anthropology, of which Prof. F. W. Putnam is the chief, a section of psychology has been established at the World's Fair. The object of this section is to exhibit, in a typical rather than exhaustive way, the methods and results of modern psychology. The exhibit falls into two parts; the one a working laboratory for making tests of the sense powers, movements and simple mental processes, and the other an exhibit of apparatus, facilities, and results of research; the exhibits are to be labelled and made as serviceable, from a pedagogical point of view, as possible. In the working laboratory it is proposed to make tests upon visitors and to publish a statistical study of the material thus collected. In order to render

these tests as expeditious and serviceable as possible, many records are desired before the opening of the Fair, and the co-operation of all experimental psychologists is earnestly invited in the gathering of such tests. These preliminary results will furnish a norm or standard by which individuals may be classified. The final plans are not yet matured, but the interest and co-operation of all psychologists is desired. Communications should be addressed to Prof. Joseph Jastrow, University of Wisconsin, Madison, Wis., in whose charge the section of psychology has been placed.

WELLS, *Clinical report of three cases of insanity of childhood*, Journal of Nerv. and Ment. Diseases, 1891, N. S. XVI. 292.

The cases of two girls (aged 15 and 11 respectively) and of one boy (aged 14) are carefully detailed. He regards the contemporaneous physical disturbances in these cases (e. g., chorea in that of the elder girl) "more as a consequence of the mental disturbance than as the causative factor of the perverted ideas." The majority of cases of child insanity fall rather under the class of idiocy or imbecility, which some maniacal excitement can accompany. In intellectual deficiency, then, Dr. W. finds the cause of most insanity in children; into the cause of the imbecility, he very properly does not go in this report.

University of Texas.

WALTER LEFEVRE.

SOME POINTS IN LINGUISTIC PSYCHOLOGY.

A. F. CHAMBERLAIN, PH. D.

Whilst lying awake at night in the region of Kootenay, British Columbia, the writer was but too often made aware of the presence of owls by their loud and expulsive hoots. After listening for some time one evening to the sonorous *tu-whit-tu-whit-tu-whu* of these nocturnal minstrels, it suddenly occurred to him to ask his Kootenay Indian companion what the owls were saying. He responded without hesitation that the owl spoke two things: (a) *k'ätkênëtl pátlkë*; (b) *kátskakítl pátlkë*. The meaning of these phrases the writer is not able to explain as yet (but *pátlkë* = woman). The owl's note did not seem to vary any, although the Indian declared the owl said the two different things.

By and by the writer, without being conscious of any particular effort on his part, ceased to hear the *tu-whit-tu-whit-tu-whu*, so familiar to him, and the sounds that reached his ears were: *k'ätkênëtl pátlkë*, *kátskakítl pátlkë*, these phrases, with the exception of the word *pátlkë*, being before entirely unknown to him, and he being ignorant of their real signification. Moreover, by a very slight effort, he was able to interchange these sounds, and to hear at will the common English or the Kootenay Indian rendering of the owl's cry. The writer took particular cognizance of the fact at the time, and when returning by the C. P. R. made the experiment of repeating words and stanzas of verse with different stress and accentuation to the series of noises made by the wheels of the cars as they reached the end of each rail. He found that, be the measure of the verses what it might, the correspondence between it and the click of the rails could still be maintained.

Mr. Cameron, of Toronto University, informed the writer, when discussing the matter, that he had noticed that similar effects were produced by experimenting in a like manner with the ticking of a clock or any noise of that kind.

The possibility of shifting from Kootenay to English in the case of the owl's cry may be susceptible of explanation in this way, partly at least. Sir Daniel Wilson¹ has recorded a similar case—it would be exactly the same if the writer's Indian had been able to hear the *tu-whit-tu-whit-tu-whu*.

"Oronyhateka, an educated Mohawk Indian, in replying to some queries addressed to him relative to his native language, thus writes me in reference to the *Caprimulgus vociferus*, or whip-poor-will: 'When I listen with my Indian ears it seems to me utterly impossible to form any other word from an imitation of its notes than *kwa-kor-yeuh*, but when I put on my English ears I hear the bird quite distinctly saying *whip-poor-will*.' Assickinack, an educated Odahwah Indian, wrote the same cry—heard nightly throughout the summer in the American forests—*wha-oo-nah*, and an Englishman, recently arrived in Canada, who listened to this cry for the first time, without being aware of the popular significance attached to it, wrote it down at my request, *eh-poo-weh*."

It is evident that a psychological study of onomatopoeia would lead to some interesting and valuable results.

Some nine months ago the writer conducted a short series of experiments in this line. A series of unmeaning collections of letters (pronounced in the ordinary English fashion) were given one by one to the subject, and he was requested to state the sound which he thought was best represented by the group of letters given him. Following is the result in three cases:

¹ Prehistoric Man, 3rd ed. (1876) II. 346.

A.

WORD USED.	SOUNDS THOUGHT OF BY SUBJECTS.		
	SUBJECT No. I.	SUBJECT No. II.	SUBJECT No. III.
Brűv.	Dog barking.	None.	Sound made by pushing the hand or fist along a board or a piece of cloth.
Chlip.	Ring of metal; snap of thin razor blades.	None.	Chirping of a chipmunk.
Glab.	Dropping of something semi-liquid, nearer the solid than the liquid state.	Croaking of a frog.	Clapping of the hands together.
Göp.	Upsetting of a bowl of mush.	Sound made by a man gulping down something.	Sound made by a German drinking beer.
Hěz.	Puffing, expelling the breath forcibly.	Sound made by a humble-bee.	Noise made by twisting a wisp of dried hay.
Hűth.	Same as <i>hez</i> , but more strongly.	The sound a man makes when he wishes another to keep quiet.	Hiss of a goose.
Jal.	None.	None.	One of the lower notes of an organ.
Kig.	Noise made in trying to suppress laughter; the gurgle of any liquid.	The sound vinegar makes running out of a barrel.	A sudden blow on something not especially hard.
Lűs.	Striking with a "awish"; the idea of a cloth striking something and winding around it.	Hiss of a snake.	Stroke of a plane, or the stroke of a broom on the floor.
Snöm.	A resonant sound in a lower note.	None.	Sneezing.
Splan.	A blow against a door; a blow followed by vibration.	None.	Striking two tins together.
Thrin.	A snapping sound, not sharp.	None.	The twang of a violin string.
Yöz.	None.	None.	The squeak of a badly oiled vice when being screwed up.
Zém.	Noise made by a nail flying through the air.	Buzz of a spindle.	Sound of a buzz-saw.
Zűt.	None.	None.	The breaking of a fiddle string.

The subjects experimented upon were members of the university, and gave their answers almost immediately.

The same three subjects were further requested to state upon what thing they would confer the name in question as being most appropriate, and also to state what word each of these meaningless groups of letters called up by its sound. The results were as follows:

B.

WORD USED.	GIVEN AS A NAME BY SUBJECTS.		
	SUBJECT I.	SUBJECT II.	SUBJECT III.
Brûv.	A mountain.	A brother.	A sturdy character.
Chîlp.	A very "fresh" person.	A child.	The idea of active or brisk.
Glab.	A person who talks too much.	Foolish chatter.	Something powerful.
Gôp.	A horse.	A "gawk"; a country fellow.	A pebble.
Hez.	A goose; a snake.	A bumble-bee.	Something waste or wild.
Hûth.	As an adjective to something held in contempt.	A horse.	Sulkiness.
Jal.	Glass.	A girl.	A vessel for containing liquids.
Klg.	The gurgle of any liquid.	A carriage.	A dog.
Lûsh.	Noise made in wading through water.	Wife.	A liquid.
Snôm.	The tolling of a bell.	A cow.	A storm.
Splan.	A horse.	A plough.	A level plain.
Thrin.	A sleigh.	A rope.	An uproar.
Yôz.	A bumble-bee.	A hog.	A cow.
Zêm.	A cow.	A watch.	A house.
Zût.	A flash of lightning.	An axe.	A deep ravine or canyon.

C.

WORD USED.	SUGGESTED TO SUBJECT I.	SUGGESTED TO SUBJECT II.	SUGGESTED TO SUBJECT III.
Bräv.	Brother.	Brother.	Brave; love.
Chilp.	None.	Child.	Child; Chiltern hundreds.
Glab.	Glob.	Blab.	Blab; glade.
Héz.	Es. (Ger.)	None.	Has; fez.
Göp.	Stop.	Gap.	God; got.
Hüth.	Huff.	House.	Heath; huff.
Jal.	Jell. (v.)	Girl.	Jail; jelly.
Kig.	Kick.	Keg.	Kick; keg.
Lüs.	Löss. (Ger.)	Lass.	Pus; luscious.
Snöm.	Snob; numb.	Snob.	Snow; snot.
Splan.	Splash.	Explain.	Plan; plain.
Thrin.	None.	String.	Thin.
Yöz.	Yes.	You.	Ya-a-s. (Yes.)
Zëm.	Zim.	Gem.	Zenana; sed.
Züt.	Soot.	Slut.	But; slut.

Educated men of the nineteenth century may not be gifted with excessive powers of onomatopœic naming, but the short series of experiments gives hope of much better results in the future. The difference in ideas and sounds called up is considerable, and taken in connection with the great variation in onomatopœia amongst savage and uncultured races seems to demand further and more searching investigation, particularly in the direction of rhythm.

Lincoln College,
Oxford, 2 Sept. 1892.

To the Editor of the
JOURNAL OF PSYCHOLOGY:

Dear Sir—

Philosophy at Oxford forms one portion of the work required in the school of *Literæ Humaniores*, which is still the most popular of the honor schools, and contains a larger proportion of able students than any other. Until within recent years, the philosophical portion was considered the most important, and it remains of equal importance with the other subject, ancient history. The consequence is that nowhere else in England (I don't include Scotland) is there so large a body of students of philosophy. The distinctive feature of the study, as pursued at Oxford, is that which it owes to its connection with the study of classical history and literature. The statutes of the examination (and the studies of the place are regulated almost entirely by the examination) prescribe "logic and the elements of moral and political philosophy;" and in these subjects certain Greek authors are required from all students. Nominally there is a considerable choice of authors, but the course has been more or less fixed by custom. Practically every one studies the "Republic" of Plato, the "Ethics" of Aristotle, parts of Aristotle's "Organon," and Bacon's "Novum Organum." This forms the staple of the work, and as many of the great questions of philosophy are raised, in one form or another, by the Greek writers, or are suggested by contrast, these books serve as text-books upon which to base both the history of the subject and the scientific treatment of it. Students are expected to study the subject in its modern form, and they study either independently, or through lectures, some of the important English works. Thos. Mill's works are read, especially the "Logic;" the better students read parts of Lotze or Mr. Bradley's work on logic, and acquire more knowledge of the great English succession, and perhaps of Kant. "Logic," I may remark, is understood in a very loose sense as equivalent to mental philosophy, as a whole, and includes metaphysics and to a certain limited extent, psychology. On account of the importance assigned to the "Ethics" and "Republic," moral philosophy has become the most prominent part of the work and produces the best results. Political philosophy is studied in close connection with it, in such books as Aristotle's "Politics," Maine's works and the like. In moral philosophy the men read such well known works as Green's, Prof. Sedgwick's, Mr. Spencer's, Dr. Martineau's, and many read Kant's smaller work. Of course you will understand that there is some variety in the reading, and that, naturally it is, in general, only portions of these books which are read, and in Oxford, as elsewhere, the tendency is for the undergraduate to rely on his lectures to a greater extent than even the vanity of the lecturers themselves would think desirable. Besides this general course of study, special authors or books may be offered as special subjects, and sometimes are, such as Aristotle's "Politics," or "de Anima," Locke, Hume, Kant's critique and the like. Experimental psychology is one of these subjects, but has never been offered as yet, to my knowledge.

Any one who looks at the list of lectures given will be struck at first sight by two things, the great number of lecturers and the multiplication of lectures on certain subjects. These are consequences of the college system. Each college supplies a lecturer, and there is a natural tendency to lecture on the regular subjects. Including the three professors, there are as many as twenty persons giving lectures in philosophy, and in any one year there will be as many as 4 or 5 different lectures on each of the two staple books, the "Ethics" and the "Republic." All lectures are open to the whole University, but there is not

much organization for division of the labor. It would be tedious to enumerate all the subjects usually given in lectures. Prof. Wm. Wilson lectures at present on systematic logic, sometimes on Aristotle's logic. Prof. Wallace lectures on the history of ethical theories, and on other ethical subjects. Prof. Case on Aristotle's metaphysics, and on Aristotle's and Bacon's logic, and on general metaphysical questions. There are other lectures on logic, on Bacon and Aristotle, on the English philosophers of the 17th and 18th centuries, elementary metaphysics, philosophical terms, on the English moralists, on Kant's ethics, and on moral and political philosophy as a whole. Mr. D. G. Ritchie, of Jesus College, is one of the most popular lecturers on political philosophy. I will not mention the names of many of the lecturers. One of the most influential has been Mr. R. L. Nettleship, of Christ's, the editor of Green's works, who has just been taken from us by an untimely and melancholy death. Greek philosophy offers a field for many distinguished scholars, like Prof. Jewett, Mr. Bywater, Mr. J. A. Stewart. Writing for a journal of psychology, I have to confess with regret that systematic lectures on psychology are infrequent. Wm. Blunt of Christchurch has lectured on the subject, and I now give a course of lectures, and hope to extend activity in this direction. To some extent psychology is treated in the lectures on logic. But the subject of psychology is the most glaring weakness of the Oxford teaching of philosophy.

The lecture list gives a very imperfect idea of the system of teaching, a large part of which is done privately by the college tutors. It is the custom for each student to bring a written essay on some philosophical subject to his tutor at stated times, generally once a week during certain terms. These meetings give the tutor an opportunity of discussing questions thoroughly with his pupils, and at the same time of suggesting courses of reading to suit their special tastes and aptitudes. Many persons think this the most valuable part of the training, and it is certainly the most characteristic feature of the Oxford system. Others, while admitting its value in many cases, think it wasteful to the energies of the teacher, without producing a proportionate advantage to the taught. Any one who has seen the large amount of solid and able work which is produced in the examination, must admit that the teaching, whether by public lectures or private tuition, is highly effective.

But the demands made by the examination on the men are so great (for they have to read Greek and Roman history as well as the original writers) that there is necessarily little room left except in the case of the ablest men for originality to show itself.

It is not very easy to say what the prevalent character of the teaching in philosophy is. The lecturers do not often try to profit by attending each other's lectures, and one has to guess from the best produced by the men in examination, which does not at present indicate any very dominant mode of thinking amongst the lecturers. Until recently the influence of T. H. Green was very marked, and on the whole this philosophy is still the strongest. But, the spell of Green's personality removed, the idealistic German philosophy by which Oxford has been so deeply influenced has lost much of its potency, must I say for evil or for good? In general the atmosphere is more favorable to criticism than to construction. An outsider might justly charge the University with what Mr. Spencer calls the anti-patriotic bias in philosophy. We have been so occupied with the defects of our homebred philosophy that we have neglected its merits. I should mention, while speaking of the character of the teaching, that our most eminent resident worker in philosophy and psychology, Mr. F. H. Bradley, has never taught in lectures, and another eminent writer who used to be a lecturer, Mr. Bosanquet, lectures at Oxford no longer.

The list of lectures from which I have quoted shows a considerable variety of subjects which are lectured upon. And, of course, it gives no clue to the special private studies of individual teachers, and to the possibilities of special guidance which a student would be sure to find from some one teacher or other, amongst so many engaged on the subject. Still the connection of philosophy with other subjects like ancient history, while it has peculiar merits and is remarkably successful in its results, makes it difficult to study the science as a whole very fully, or its more special department in any detail at all. There are at present no post-graduate courses such as you have in the United States. Perhaps greater opportunities will be given in the future for those who wish to study the subject without giving too much attention to Greek authorities. A full recognition of the claims of psychology is especially to be desired. It is a welcome fact, at the present term, that the younger graduates are turning more and more to this subject. Before long we may, I trust, have a laboratory for experimental psychology. It is not too much to hope that the university of Hobbes and Locke may once more contribute by active teaching and active study to that philosophical subject which is most closely associated with the name of England. Believe me

Yours very truly,

S. ALEXANDER.